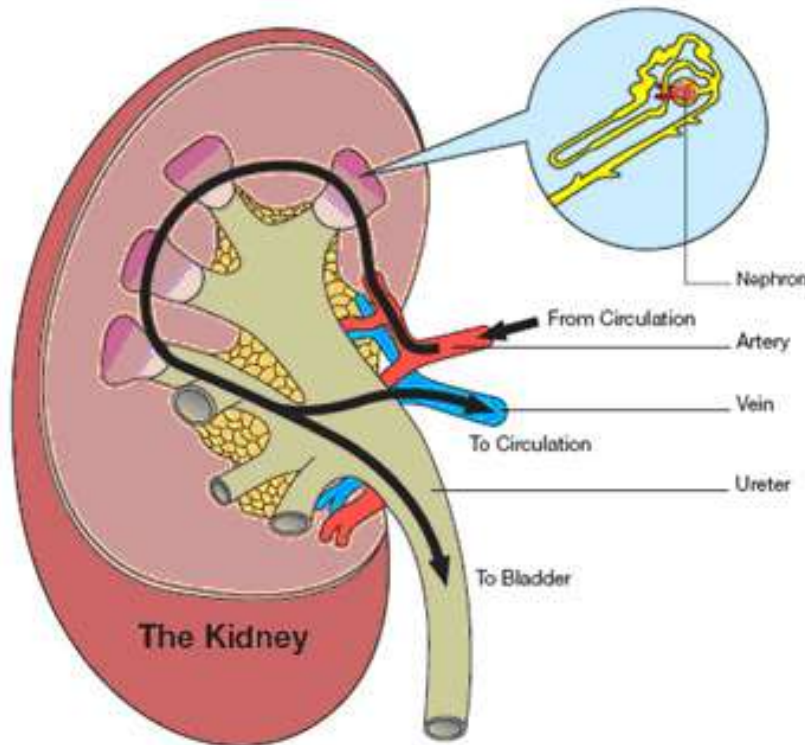


Approach to the Patient with Affection and Disease of the Kidneys

LECTURE IN INTERNAL MEDICINE PROPAEDEUTICS

M. Yabluchansky, L. Bogun, L.Martymianova, O. Bychkova, N. Lysenko, N. Makienko
V.N. Karazin National University Medical School' Internal Medicine Dept.

Plan of the lecture



Approach to the Patient with Affection and Disease of the Kidneys

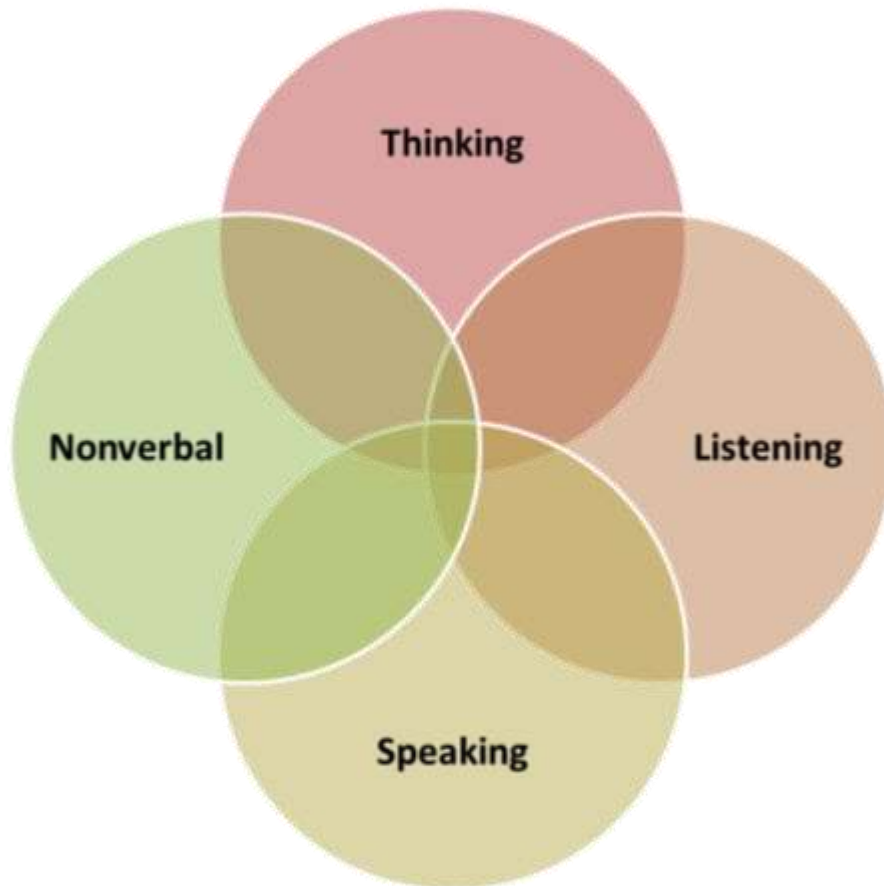
- Interviewing of the patient
- Physical examination of the patient
- Instrumental methods
- laboratory methods

Interviewing of the patient: four overlapping processes

1. *engaging* (connecting with patients and establishing a good working relationship)
2. *focusing* (agreeing on the target of motivational enhancement and directing the conversation toward it)
3. *evoking* (drawing out the patients' own motivations for changing the target behavior)
4. *planning* (developing commitment to change and formulating a specific plan of action)



Interviewing of the patient: Good questions to get started on the core interview



Communication skills:

- Active listening
- Empathy
- Building rapport
- Open-ended questions
- Leading questions
- Silence
- “Why” questions
- Nonverbal communication cues

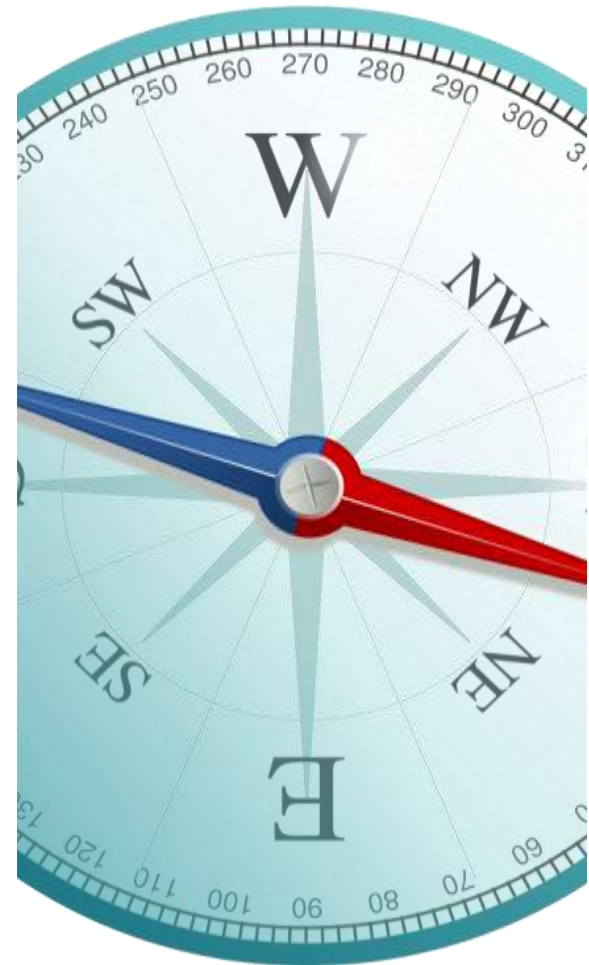
Interviewing of the patient: Good questions to get started on the core interview

- What is your chief complaint?
- Tell me why you're here today
- Tell me about your injury
- What can I do to help you?
- Explain to me your understanding of your injury



Interviewing of the patient: Patient profile

- Age
- Sex
- Race/Ethnicity
- Handedness
- Ht-Wt-BMI-Body type
- Primary language
- Barriers to learning
- Learning preference
- Unique rehabilitation goals



Interviewing of the patient: complaints

- Kidney' lumbar and abdominal pain
- Disordered urination
- Swelling of the legs and puffiness around the eyes
- Fatigue and weakness
- High blood pressure
- Headache
- Dizziness
- Deranged vision
- Dyspnea
- Loss of appetite, nausea and vomiting
- Changes in the urine -- its color, odor, and consistency
- Hyperthermia
- Thirst
- Itching, easy bruising, and pale skin
- Bleeding
- Numbness in the feet or hands
- Disturbed sleep
- Restless legs syndrome
- Shortness of breath from fluid accumulation in the lungs
- Chest pain due to pericarditis
- Bone pain and fractures
- Muscle twitching or cramping
- Decreased sexual interest and erectile dysfunction

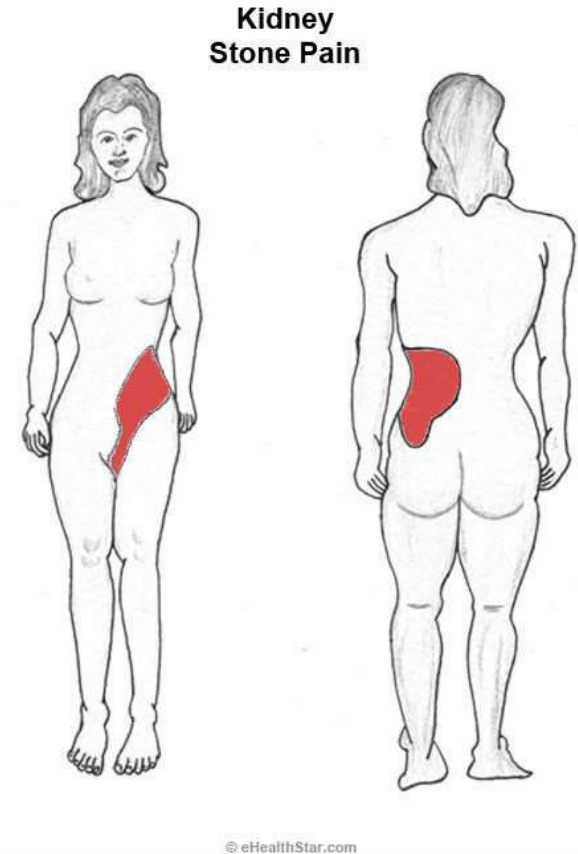
Interviewing of the patient: complaints (kidney' lumbar pain)

- Kidneys' lumbar pain caused by the kidneys is typically felt in the flank area, which is in the back, just at the lower edge of the ribs on either side of the spine
- This pain caused by the kidneys tends to be sharp and severe, to and occur in waves
- Depending on the cause, it may radiate down the flank to the groin or toward the abdominal area
- Some individuals may develop fever, painful urination (dysuria), blood_in_the urine, nausea, and vomiting
- The renal tissue is devoid of pain receptors and the pain is felt when the capsule or the pelvis is distended



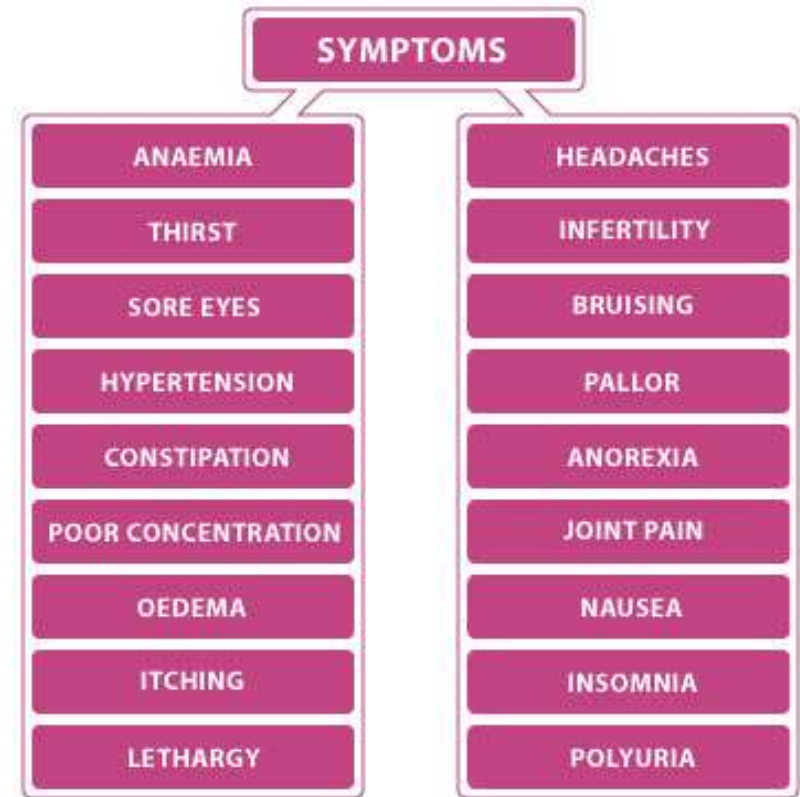
Interviewing of the patient: complaints (kidney' abdominal pain)

- Kidney' abdominal pain names renal colic and commonly caused by kidney stones
- Renal colic typically begins in the abdomen and often radiates to the hypochondrium or the groin
- It is typically colicky (comes in waves) due to ureteric peristalsis, but may be constant and is often described as one of the strongest pain sensations known
- The pain occurs when a stone becomes lodged in the ureter, the slender tube that connects the kidney with the bladder



Interviewing of the patient: complaints (kidney' pain causes)

- Bleeding in kidney (hemorrhage)
- Blood clots in kidney veins (renal vein thrombosis)
- Urinary tract infection
- Arteriosclerosis /atherosclerosis
- Horseshoe kidney
- Kidney tumor
- Kidney infection (pyelonephritis)
- Kidney swelling due to a backup of urine (hydronephrosis)
- Polycystic kidney disease



Interviewing of the patient: complaints (disordered urination)

- Dysuria
- Diuresis
- Urinary frequency
- Nocturia
- Isuria
- Urinary hesitancy
and slow urination
- Incontinence



Interviewing of the patient: complaints (dysuria)

- Dysuria is painful or uncomfortable urination, typically a sharp, burning sensation
- Some disorders cause a painful ache over the bladder or perineum
- Dysuria is an extremely common symptom in women, but it can occur in men and can occur at any age
- The most common causes of dysuria are cystitis and urethritis due to a sexually transmitted disease (STD)



Interviewing of the patient: complaints (diuresis)

- Diuresis is defined as secretion of urine during a certain period of time
- Increased diuresis occurs in diabetes mellitus and diabetes insipidus, acute renal failure, during mild to moderate hypothermia (cold-induced diuresis)
- Coffee, tea, certain foods, diuretic drugs, anxiety, fear, some steroids cause increase diuresis
- Types of diuresis:
 - Positive (the amount of urine excreted exceeds the volume of liquid taken)
 - Negative (the reverse ratio)



Interviewing of the patient: complaints (urinary frequency)

- Urinary frequency is the need to urinate many times during the day, at night (nocturia), or both but in normal or less-than-normal volumes
- Frequency may be accompanied by a sensation of an urgent need to void (urinary urgency)
- Urinary frequency is distinguished from polyuria, which is urine output of >3 L/day
- The most common causes of urinary frequency are urinary tract Infection (UTIs), urinary incontinence, benign prostatic hyperplasia (BPH), urinary tract calculi



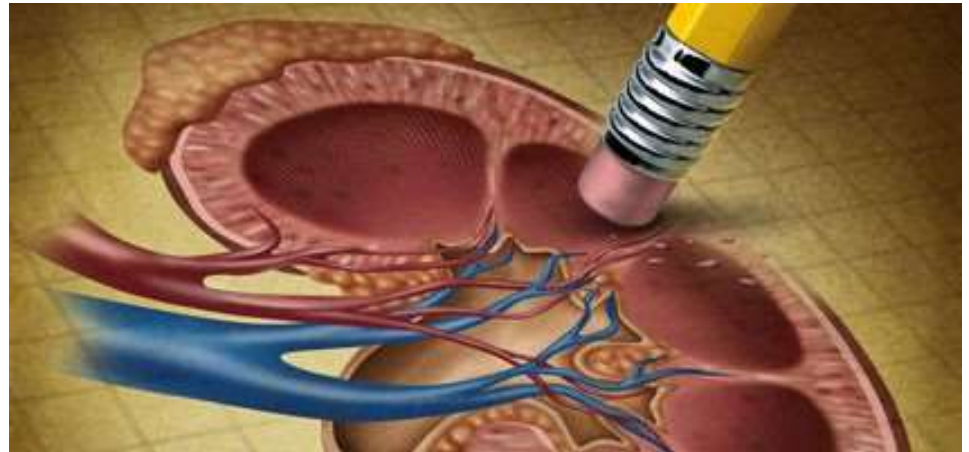
Interviewing of the patient: complaints (nocturia)

- A healthy person urinates during night not more than once
- Nocturia is a condition in which the individual has to wake at night one or more times for voiding
- Nocturia has four major underlying causes: global polyuria, nocturnal polyuria, bladder storage disorders, or mixed etiology
- Causes:
 - Cardiac (after oliguria during day time occurs in cardiac decompensation and is explained by a better renal function at night, i.e at rest)
 - Renal (may concur with polyuria in renal dysfunction, at the final stage of chronic glomerulonephritis, chronic pyelitis, vascular nephrosclerosis and other chronic renal diseases)



Interviewing of the patient: complaints (Isuria)

- Isuria is an excretion of urine at a uniform rate (about equal intervals with evacuation of about equal portions of urine)
- The most common cause of isuria is chronic renal insufficiency



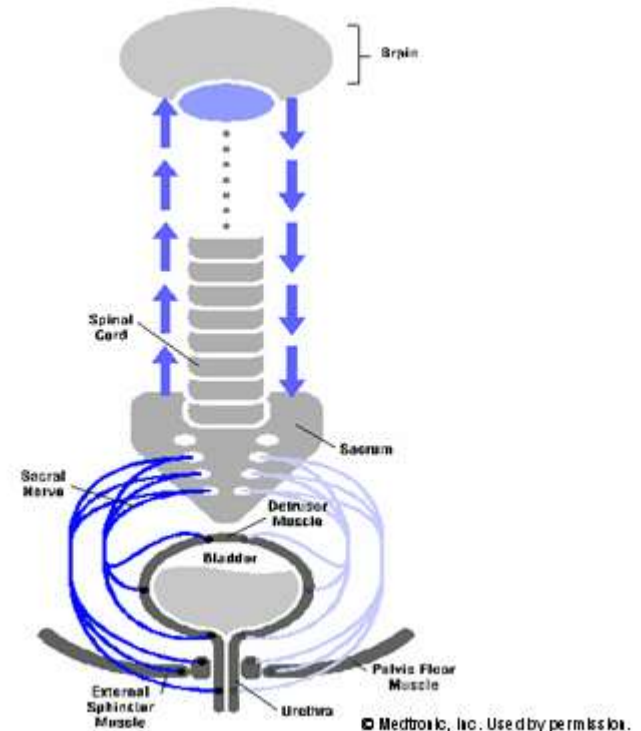
Interviewing of the patient: complaints (urinary hesitancy and slow urination)

- Urinary hesitation is a difficulty in beginning the flow of urine
- Slow urination is a slow urinary flow
- The most common causes of urinary hesitation and slow urination are urethral obstruction due to benign prostatic hyperplasia, prostatitis, urinary tract infection, cystitis, medications (nasal decongestants, tricyclic antidepressants, and anticholinergics which may be used for incontinence) etc.



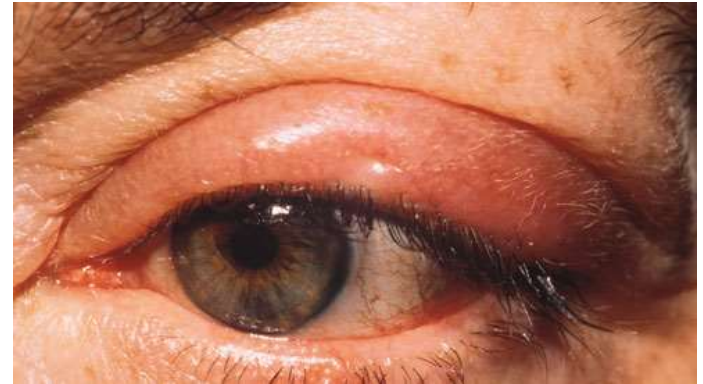
Interviewing of the patient: complaints (incontinence)

- Incontinence is an inability to control urination voluntarily
- Incontinence may involve periodic involuntary urination, or a continual, slow trickle of urine from the urethra
- Incontinence may result from urinary bladder or urethral problems, damage or weakening of the muscles of the pelvic floor, or interference with normal sensory or motor innervation in the region
- Renal function and daily urinary volume are normal



Interviewing of the patient: complaints (swelling of the legs and puffiness around the eyes)

- Swelling of the legs and puffiness around the eyes (oedema) in patients with kidney disease is for two reasons:
 - A heavy loss of protein in the urine
 - Impaired kidney (renal) function



Interviewing of the patient: complaints (fatigue and weakness)

- Kidneys disease , which cause fatigue and weakness when the concentration of certain chemicals in the blood builds up to toxic levels or from anemia



Interviewing of the patient: complaints (high blood pressure)

- High blood pressure caused by the kidneys' hormonal response to narrowing of the arteries supplying the kidneys (renal artery stenosis) called renal (secondary) hypertension
- Due to low local blood flow, the kidneys mistakenly increases blood pressure of the entire circulatory system
- Patients with renal hypertension have a diastolic blood pressure of more than 100 mmHg and are at increased risk of end organ dysfunction, including permanent kidney damage, if inadequate pharmacologic therapies are used to control blood pressure



Interviewing of the patient: complaints (headache)

- Headache is a rare symptom for kidney disease patients
- Other causes:
- Main causes the headache in kidney disease:
 - waste product accumulation
 - renal anemia
 - high blood pressure
 - Headache is a common side effects of some drugs used for treatment of kidney disease, such as steroids therapy etc.



©1991, Novartis Pharmaceuticals Corporation. All rights reserved.

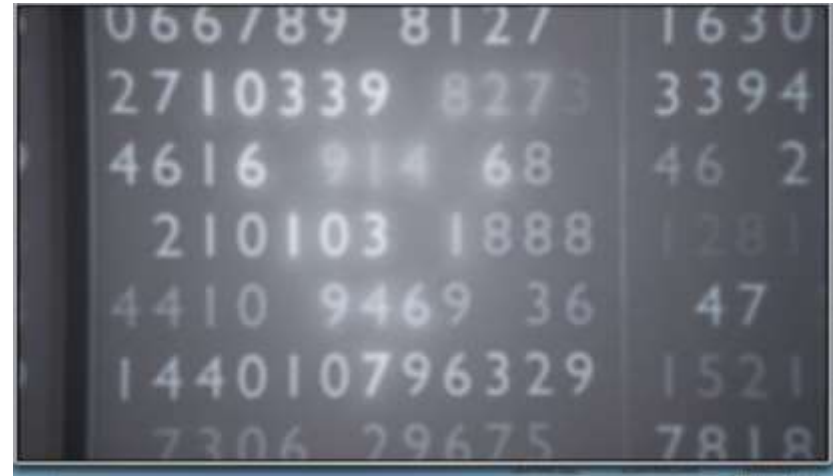
Interviewing of the patient: complaints (dizziness)

- Anaemia associated with kidney disease depletes patient's brain of oxygen which may cause dizziness
- Other causes:
 - Sleep disorder
 - Uremic toxins
 - Dialysis side effect



Interviewing of the patient: complaints (deranged vision)

- Vision may be affected because of papilloedema (swelling of the optic disc)



Interviewing of the patient: complaints (dyspnea)

- Shortness of breath is one of the symptoms in kidneys diseases
- Main causes:
 - metabolic acidosis
 - Serious fluid retention



Interviewing of the patient: complaints (loss of appetite, nausea and vomiting)

- Loss of appetite due to nausea and vomiting is classical signs of uremia in kidneys diseases



Interviewing of the patient: complaints (hyperthermia)

- Hyperthermia is elevated body temperature due to failed thermoregulation that occurs when a body produces or absorbs more heat than it dissipates
- Extreme temperature elevation then becomes a medical emergency requiring immediate treatment to prevent disability or death
- Hyperthermia is a core (oesophageal, tympanic) temperature above 40.5°C
- Hyperthermia may be an extreme form of pyrogen-induced fever associated with infection, inflammation, neoplasia, and acute renal failure



Interviewing of the patient: complaints (thirst)

- Thirst is the craving for fluids, resulting in the basic instinct to drink
- Thirst is an essential mechanism involved in fluid balance
- Thirst arises from a lack of fluids or an increase in the concentration of certain osmolites, such as salt
- If the water volume of the body falls below a certain threshold or the osmolite concentration becomes too high, the brain signals thirst
- Continuous dehydration can cause many problems, but is most often associated with renal problems and neurological problems such as seizures
- Excessive thirst, known as polydipsia, along with excessive urination, known as polyuria, may be an indication of diabetes mellitus or diabetes insipidus

Interviewing of the patient: complaints (thirst)



Interviewing of the patient: complaints (itching, easy bruising, and pale skin)

- Itch is a sensation that causes the desire or reflex to scratch, and has many similarities to pain, and while both are unpleasant sensory experiences, their behavioral response patterns are different; pain creates a withdrawal reflex, while itch leads to a scratch reflex
- Bruising easily means that the small blood vessels beneath the skin break easily and frequently, they then leak blood into the surrounding tissue and create discolorations
- Human skin color ranges in variety from the darkest brown to the pale and lightest pinkish-white hues
- These skin changes often caused in chronic kidneys diseases patients

Interviewing of the patient: complaints (itching, easy bruising, and pale skin)



Interviewing of the patient: complaints (bleeding)

- Bleeding, technically known as hemorrhaging or haemorrhaging , is blood escaping from the circulatory system
- Bleeding can occur internally, where blood leaks from blood vessels inside the body, or externally, either through a natural opening such as the mouth, nose, ear, urethra, vagina or anus, or through a break in the skin
- A healthy person can endure a loss of 10–15% of the total blood volume without serious medical difficulties
- Platelet dysfunction is the main factor responsible for hemorrhagic tendencies in advanced kidney disease, and occurs both as a result of intrinsic platelet abnormalities and impaired platelet-vessel wall interaction
- Patients with end-stage renal disease develop bleeding disorders mainly in the form of diatheses at cutaneous, mucosal, or serosal sites, etc.

Interviewing of the patient: complaints (bleeding)



Interviewing of the patient: complaints (numbness and tingling in the feet or hands)

- Numbness and tingling are unusual prickling sensations that can happen in any part of human body, but they are generally noticed in hands, feet, arms, and legs
- Causes of tingling in the hands and feet include diabetes, kidney disorders, liver disease, vascular damage and blood diseases, amyloidosis, connective tissue disorders and chronic inflammation, hormonal imbalances (including hypothyroidism), and cancers and benign tumors that impinge on nerves



Interviewing of the patient: complaints (disturbed sleep)

- Common conditions often associated with sleep problems include heartburn, diabetes, cardiovascular disease, musculoskeletal disorders, kidney disease, mental health problems, neurological disorders, respiratory problems, and thyroid disease
- Kidney disease can cause waste products to build up in the blood and can result in insomnia or symptoms of restless legs syndrome
- Nocturia is the need to get up frequently to urinate during the night, and is a common cause of sleep loss, especially among older adults



Interviewing of the patient: complaints (restless legs syndrome)

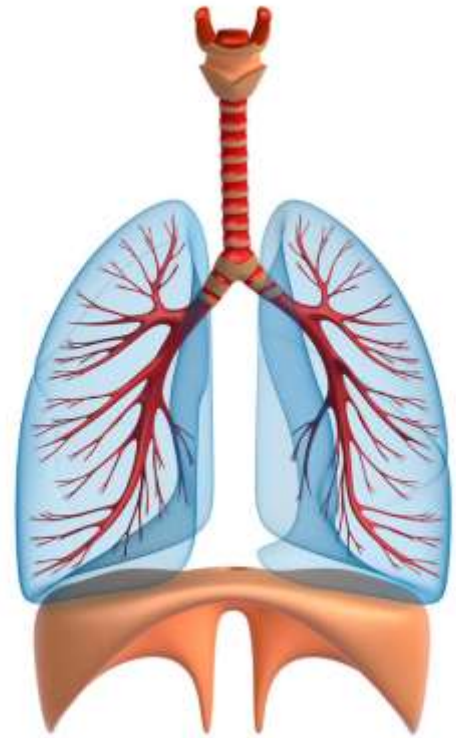
- Restless legs syndrome (RLS) is a disorder characterized by throbbing, pulling, creeping, or other unpleasant sensations in the legs and an uncontrollable, and sometimes overwhelming, urge to move them
- Symptoms occur primarily at night when a person is relaxing or at rest and can increase in severity during the night
- Moving the legs relieves the discomfort
- RLS often is related to the chronic kidney failure, diabetes, and peripheral neuropathy



Interviewing of the patient: complaints

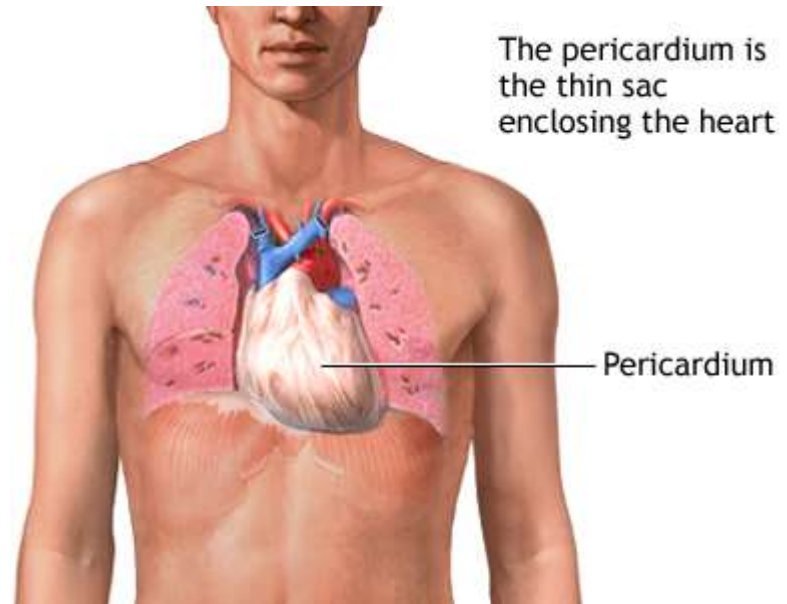
(shortness of breath from fluid accumulation in the lungs)

- Pulmonary edema that is fluid accumulation in the air spaces and parenchyma of the lungs leads to impaired gas exchange and may cause respiratory failure with shortness of breath
- In kidney disease it is due to an injury to the lung parenchyma ("noncardiogenic pulmonary edema")



Interviewing of the patient: complaints (chest pain due to pericarditis)

- Pericarditis is a condition in which the membrane, or sac, around the heart is inflamed
- In many cases, the cause of pericarditis (both acute and chronic) is unknown
- Most cases of pericarditis are the result of autoimmune disorders , kidney failure, HIV/AIDS, cancer, tuberculosis, injuries from accidents or radiation therapy, and certain medicines, like phenytoin, warfarin and heparin, atc.



Interviewing of the patient: complaints (bone pain and fractures)

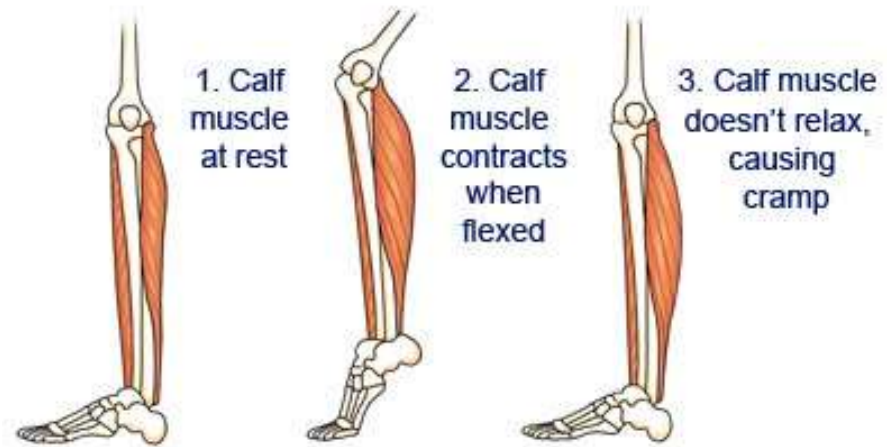
- Bone pain is coming from the bone and occurs as a result of a wide range of diseases and/or physical conditions such as chronic kidneys diseases
- Bone pain belongs to the class of deep somatic pain, often experienced as a dull pain that cannot be localized accurately by the patient
- Bone fracture is a medical condition in which there is a break in the continuity of the bone
- Bone fracture can be the result of high force impact or stress, or a minimal trauma injury as a result of certain medical conditions that weaken the bones, such as osteoporosis, chronic kidney disease, atc., where the fracture is then properly termed a pathologic fracture

Interviewing of the patient: complaints (bone pain and fractures)



Interviewing of the patient: complaints (muscle twitching or cramping)

- Muscle twitching or cramping, is a small, local, involuntary muscle contraction and relaxation which may be visible under the skin
- Muscle twitching or cramping have a variety of causes, the majority of which are benign, but can also be due to disturbances of the motor neurons , including chronic kidneys disease



Interviewing of the patient: complaints (decreased sexual interest and erectile dysfunction)

- Sexual dysfunction is a common finding in both men and women with chronic kidney failure
- Common disturbances include erectile dysfunction in men, menstrual abnormalities in women, and decreased libido and fertility in both sexes
- These abnormalities are primarily organic in nature and are related to uremia as well as the other comorbid conditions that frequently occur in the chronic kidney failure patient
- Fatigue and psychosocial factors related to the presence of a chronic disease are also contributory factors
- Disturbances in the hypothalamic-pituitary-gonadal axis can be detected before the need for dialysis but continue to worsen once dialytic therapy is initiated
- Impaired gonadal function is prominent in uremic men, whereas the disturbances in the hypothalamic-pituitary axis are more subtle
- By contrast, central disturbances are more prominent in uremic women

Interviewing of the patient: specific questions for set of complaints

Each of complaints will prompt a series of specific questions that will help arrive at a preliminary single diagnosis, or a group of different diagnoses



Interviewing of the patient: example of specific questions in complaint

- Character
- Location
- Severity
- Timing
- Duration
- Radiation
- Provocation
- Relieving conditions
- When did it first start?
- How often does it occur?
- Is it becoming more frequent with time?
- Were there associated symptoms
- Are the symptoms lasting longer?
- How the symptoms relate to food intake?

Interviewing of the patient: past medical history

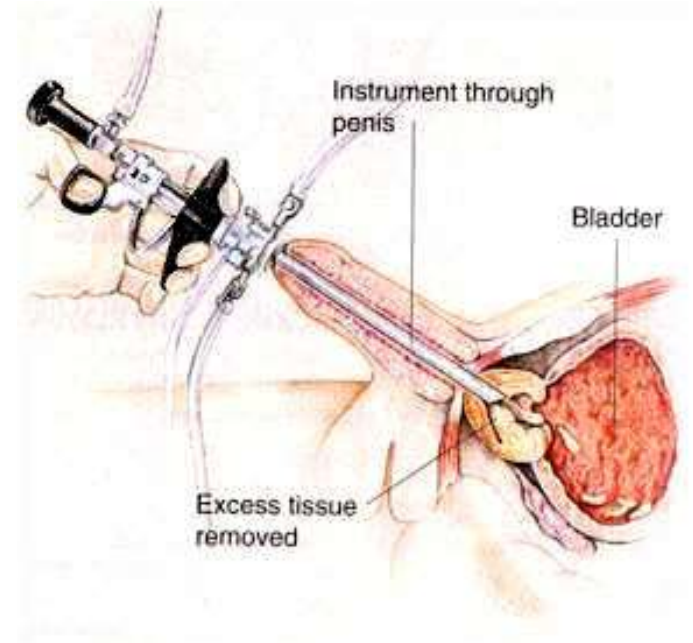
In a medical encounter, a past medical history (abbreviated PMH), is the total sum of a patient's health status prior to the presenting problem



The image shows a close-up of a medical form titled "Past Medical History". The form is divided into sections for "Cardiac" and "Chronic Illnesses". The "Cardiac" section includes options: ☐ None, ☐ Unknown, ☐ Angina, ☐ Arrhythmia, ☐ Cardiomyopathy, ☐ CHF, ☐ Congenital, ☐ Implanted Defib, ☐ MI, and ☐ Other. The "Chronic Illnesses" section includes options: ☐ None, ☐ Unknown, ☐ Abdominal, ☐ Heart, ☐ Lung, and ☐ Neurological. A black pen is resting on the form. Other visible text on the form includes "Weight", "State", "Secondary Insurance", "Secondary Insurance", "s & Group", "Chronic Illnesses", "sis/Renal", and "intestinal".

Interviewing of the patient: prior or current treatment

- Any constantly used medications
- Previous surgery (e.g., for prostatic hypertrophy)
- Injections
- Chiropractic
- Exercise/PT (Physical Therapy)
- ER (Emergency Room)
- Massage therapy



Interviewing of the patient: any constantly used medications

- Drugs prescribed for diabetes mellitus, hypertension, cardiac disorders, hormonal disorders, cancer, arthritis, and psychiatric disorders are potential causes of renal dysfunction
- The long-term use of NSAIDs, phenacetin, barbiturates, camphor, antibiotics (gentamicin, tetracyclines, penicillin G, cyclophosphamide and others) and some other medicines may seriously reduce renal function
- Dysuria can occur with the use of pumpkin seeds, the use of a number of topical hygiene products, including vaginal sprays, vaginal douches, and bubble baths

Interviewing of the patient: previous treatment and present status

- Previous Treatment
 - What?
 - Where?
 - When?
 - By whom?
- Present Status
 - Better vs. same vs. worse



Interviewing of the patient: family history and genetic risk

- Certain kidney illnesses may occur in more than one member of a family (stones, renal tumors (some types), amyloidosis, some renal anomalies)
- The physician will inquire about the health of the patient's parents, brothers, sisters and children
- A family history of kidney failure or polycystic kidney disease may be relevant to the underlying problem



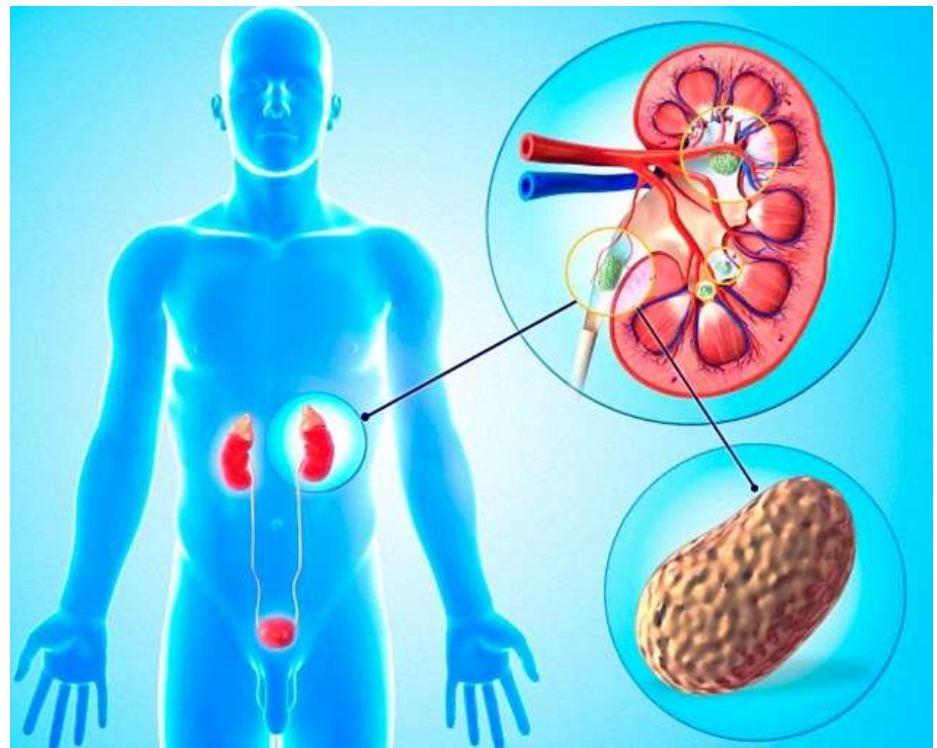
Interviewing of the patient: diet history

- A diet history is important when assessing kidneys illnesses
- Many conditions demand dietary recommendations



Interviewing of the patient: foreign travel

- Travel to Egypt or Africa may result in exposure to schistosomiasis
- Dehydration during a holiday in a hot climate may lead to the development of kidney stones



Interviewing of the patient: social history

- High-risk behaviors
 - Alcohol, tobacco, or drug abuse
 - Depression
 - Violence
 - Sedentary lifestyle
- Signs of any of the above behaviors may warrant referral to a secondary provider



Interviewing of the patient: chemical or environmental toxin exposure in occupational or other settings

Acute tubular necrosis and following acute renal insufficiency can be caused by intentional (or by mistake) exposure in industrial or domestic poisoning, such as:

- Corrosive sublimate
- Preparations of bismuth
- Phosphorus
- Silver
- Large doses of sulpha preparations



Interviewing of the patient: why take a medical history?

- Up to 90% of conditions can be accurately diagnosed or recognized by conducting a thorough medical history and listening carefully to the patient's response(s)
- Determines the necessary tests and measures you should prioritize for your objective examination



Interviewing of the patient: review of systems

- The "laundry list" of symptoms related to various organs of the body
- A series of questions helps seek out information that the patient may have neglected to provide the physician
- Review of systems helps to identify the patient's problem, or exclude different parts of the differential diagnosis



Interviewing of the patient: systemic enquiry

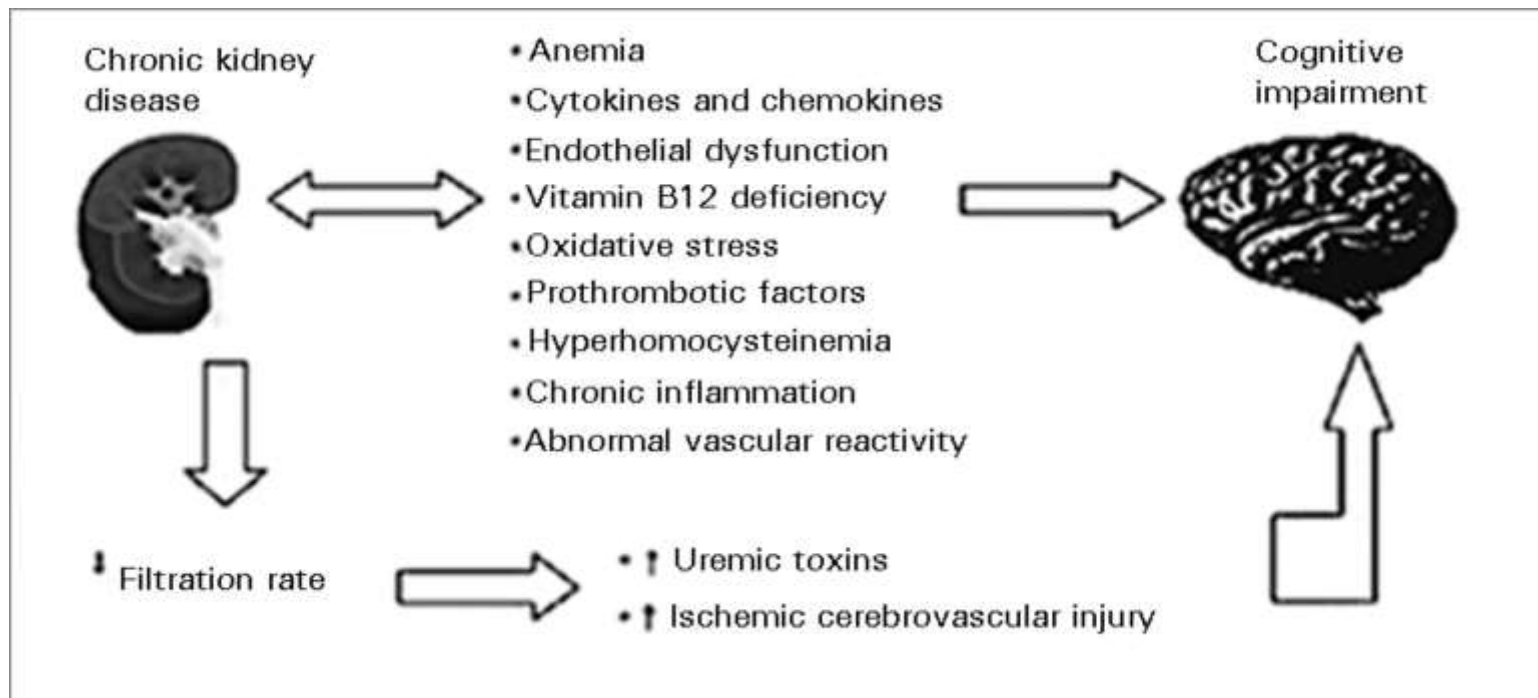
- General: fever, weight loss, loss of appetite, lethargy
- Respiratory and cardiovascular systems: shortness of breath, cough, hemoptysis, wheeze, chest pain
- Gastrointestinal system: nausea and vomiting, hematemesis, dysphagia, heartburn, jaundice, abdominal pain, change in bowel habit, rectal bleeding, tenesmus (sensation of incomplete bowel emptying)
- Gynecological system: pelvic pain, vaginal bleeding, vaginal discharge, LMP
- Neurological system: headaches, dizziness, loss of consciousness, fits, faints, funny turns, numbness, tingling, weakness, problems speaking, change in vision

Interviewing of the patient:

Kidney Disease Quality of Life Indexes

- The Kidney Disease Quality of Life Index is a questionnaire which measures Quality of Life these type of patients
- Index is a multidimensional constructs with several dimensions: emotional or psychological well being, physical functioning, social functioning, and symptoms of the disease and treatment
- A single item is also included that identifies perceived change in health, making the Indexes a useful indicators for change in Kidney Disease Quality of Life Indexes over time and treatment

Physical examination of the patient: general level of consciousness



- The patient's general level of consciousness and level of alertness must be assessed, noting deficits in concentration, thought processes, or memory
- Family members may report subtle changes
- Such cognitive changes may be the result of an insufficient clearance of waste products when renal disease is present

Physical examination of the patient: general inspection

- Whether patient is comfortable at rest
- Do patient appears to be tachypnoeic
- Are there any obvious patient' skin color changes
- Are there any obvious medical appliances around the bed (such as patient controlled analgesia)
- Are there any medications around (although this is unlikely as all medications should be in a locked cupboard)



Physical examination of the patient: general inspection

- The patient's posture in bed: active, passive (uraemic coma), forced (paranephritis, renal colic, uraemic coma, renal eclampsia, etc.)
- Oedema (an acute and chronic glomerulonephritis, nephrotic syndrome, kidneys' amyloidosis) with pallid, swollen (oedematous eyelids, narrowed eyes) face (nephritica), and in more pronounced cases with extremities and trunk (anasarca) swelling
- Pallid oedematous skin in chronic nephritis due to the spasm of arterioles, and anaemia which attends kidney disease
- Wax pallid skin can be detected in amyloidosis and lipoid nephrosis
- Scratches on the skin and coated dry tongue can be found in a patient with chronic nephritis
- An unpleasant odour of ammonia can be felt from the mouth and skin of the patient (factor uremicus)
- Lymphadenopathy; lymph nodes may be enlarged due to metastatic spread from any urological cancer

Physical examination of the patient: the patient's posture in bed



Renal colic

Physical examination of the patient: face nephritica



Physical examination of the patient: extremities swelling



Physical examination of the patient: anasarca



Physical examination of the patient: pallid oedematous skin



Physical examination of the patient: scratches on the skin



Physical examination of the patient: lymphadenopathy



Physical examination of the patient: abdominal investigation

- Abdomen may be distended due to large polycystic kidneys or ascites due to nephritic syndrome or nephrotic syndrome
- The kidneys are examined bimanually with a hand posteriorly lifting up the kidney towards the examining abdominally placed hand
- Tenderness over the kidney should be tested by gentle pressure over the renal angle
- Palpation for renal enlargement or masses (an enlarged kidney usually bulges forwards; in polycystic kidney disease, there may also be hepatomegaly from hepatic cysts)
- Percussion for the presence of ascites (shifting dullness) and for an enlarged bladder
- Auscultation for a renal bruit in renal artery stenosis (heard above the umbilicus, 2 cm to the left or right of the midline and also in both flanks with the patient sitting up)

Physical examination of the patient: the kidneys are examined bimanually

- Reach one hand round to the patient's right loin with your other hand over the right upper quadrant
- Push your hands together whilst asking the patient to breathe in and out
- Try to palpate any enlarged kidney between your two hands (called 'balloting').
- Repeat for the left kidney
- Examine for enlarged kidneys, renal masses or loin tenderness



Physical examination of the patient: percussion for the presence of ascites

- Ask the patient or an observer to place their hand longitudinally over the center of the abdomen
- Place your right hand on the left side of the abdomen and your left hand opposite, so that both are equidistant from the umbilicus
- Firmly tap on the abdomen with your right hand while your left remains against the abdominal wall
- If there is a lot of ascites present, you may be able to feel a fluid wave (generated in the ascites by the tapping maneuver) strike against the abdominal wall under your left hand



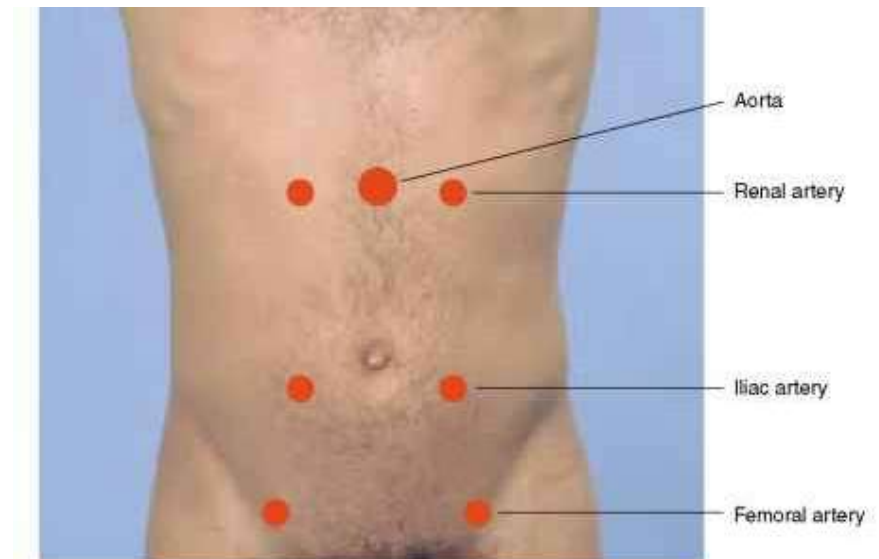
Physical examination of the patient: percussion for the urinary bladder

- Percuss your patient's bladder, beginning over symphysis pubis and working toward umbilicus
- A urine-filled bladder produces a dull sound
- A change to tympany indicates the bladder's border



Physical examination of the patient: auscultation for a renal bruit

- Subcostal bruit suggests renal artery stenosis
- Hearing a bruit over the left upper quadrant suggests left renal artery stenosis, carcinoma of the body or tail of the pancreas, massive splenomegaly, and splenic artery stenosis or dissection



Physical examination of the patient: percussion of the kidneys

- Assist the client to a sitting position, and stand behind the client
- For indirect percussion, place the palm of your monodominant hand over the costovertebral angle
- Strike this area with the ulnar surface of your dominant hand, curled into a fist
- For direct percussion, also strike the area over the costovertebral angle with the ulnar surface of your dominant hand, curled into a fist
- Repeat the technique for the other kidney
- You should do percussion of the kidneys with only enough force so the client feels a gentle thud



Physical examination of the patient: interpretation of percussion of the kidneys

- If the patient feels pain, the symptom is defined as costovertebral angle tenderness (Murphy's punch sign)
- The symptom is positive in pyelonephritis (inflammation of the kidney and upper urinary tract), nephrolithiasis (renal stone), paranephritis (inflammation of the connective tissue around the kidney, perinephric abscess), inflammation of pelvis, myositis and radiculitis

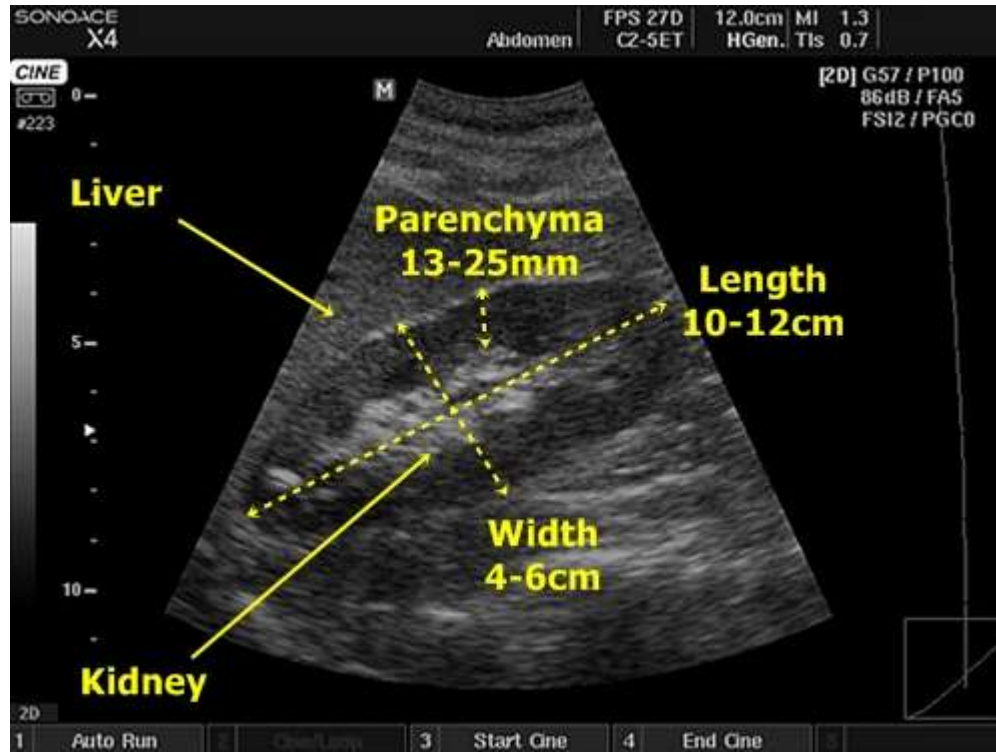


Instrumental methods: flat-plate film of the abdomen



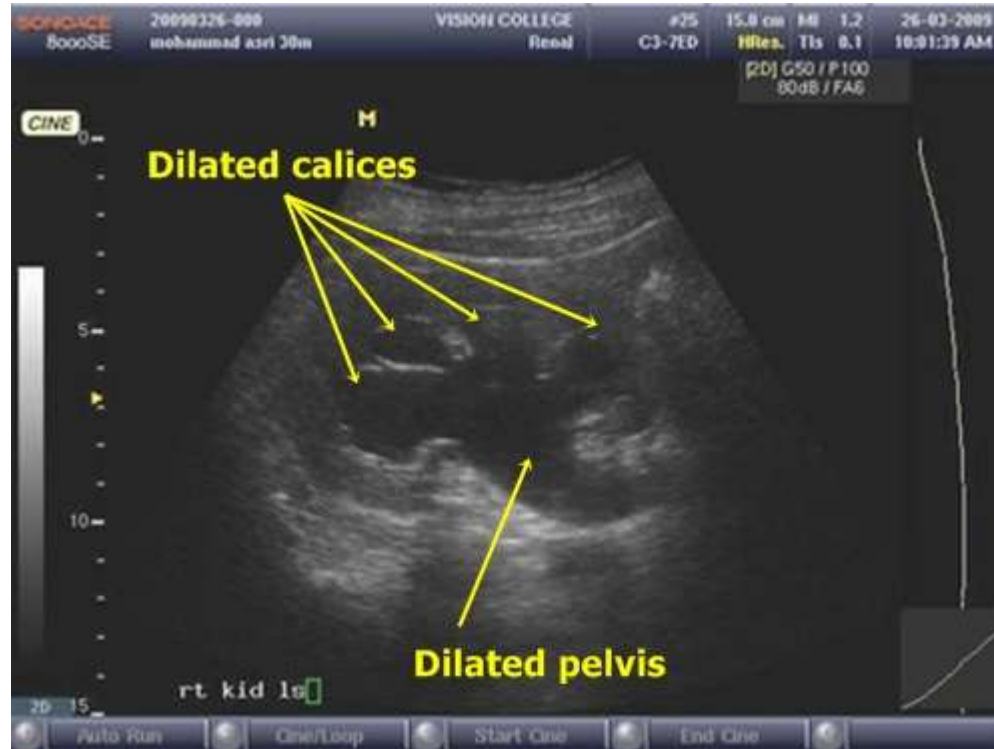
These two radiographs show the importance of including the diaphragm on the plain-film abdomen x-ray

Instrumental methods: renal sonography



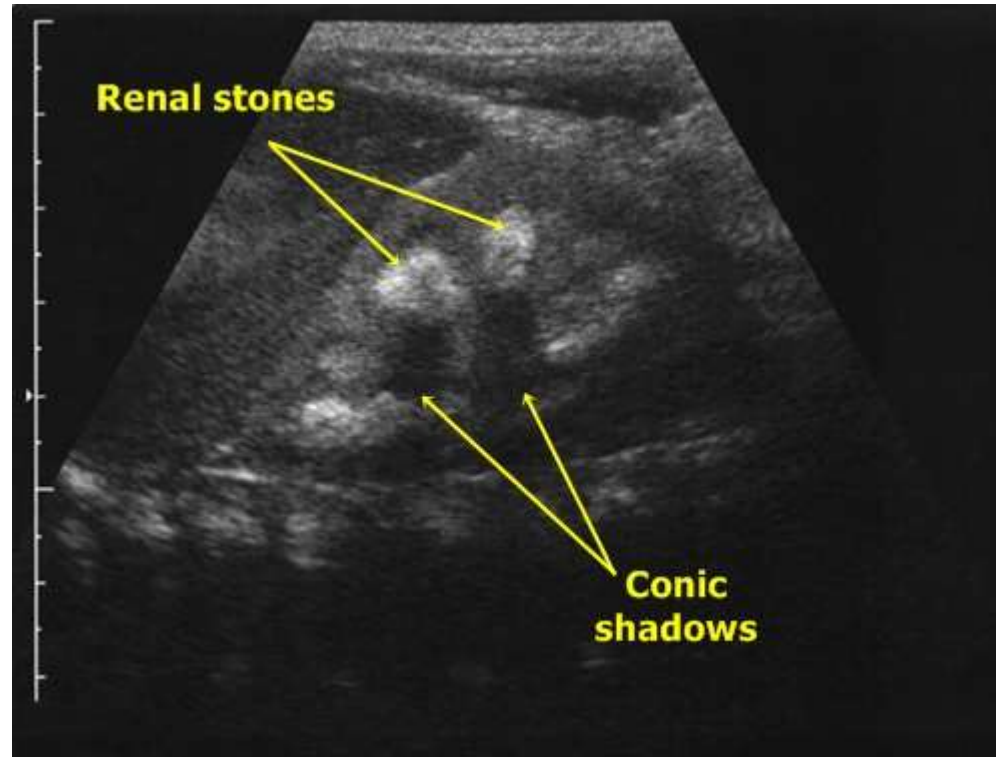
Longitudinal cut through the right kidney with marked proportions
Neighbouring liver tissue is brighter than renal parenchyma and therefore probably steatotic

Instrumental methods: renal sonography



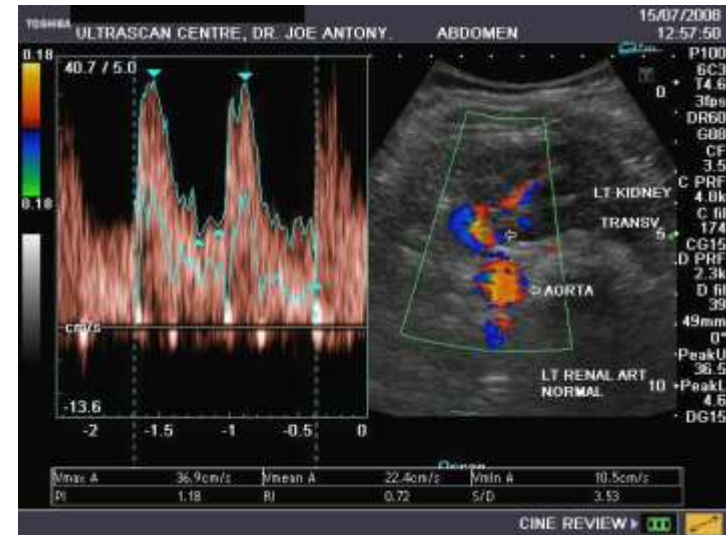
Hydronephrosis- In this picture dilatation of the pelvis and calices is visible

Instrumental methods: renal sonography



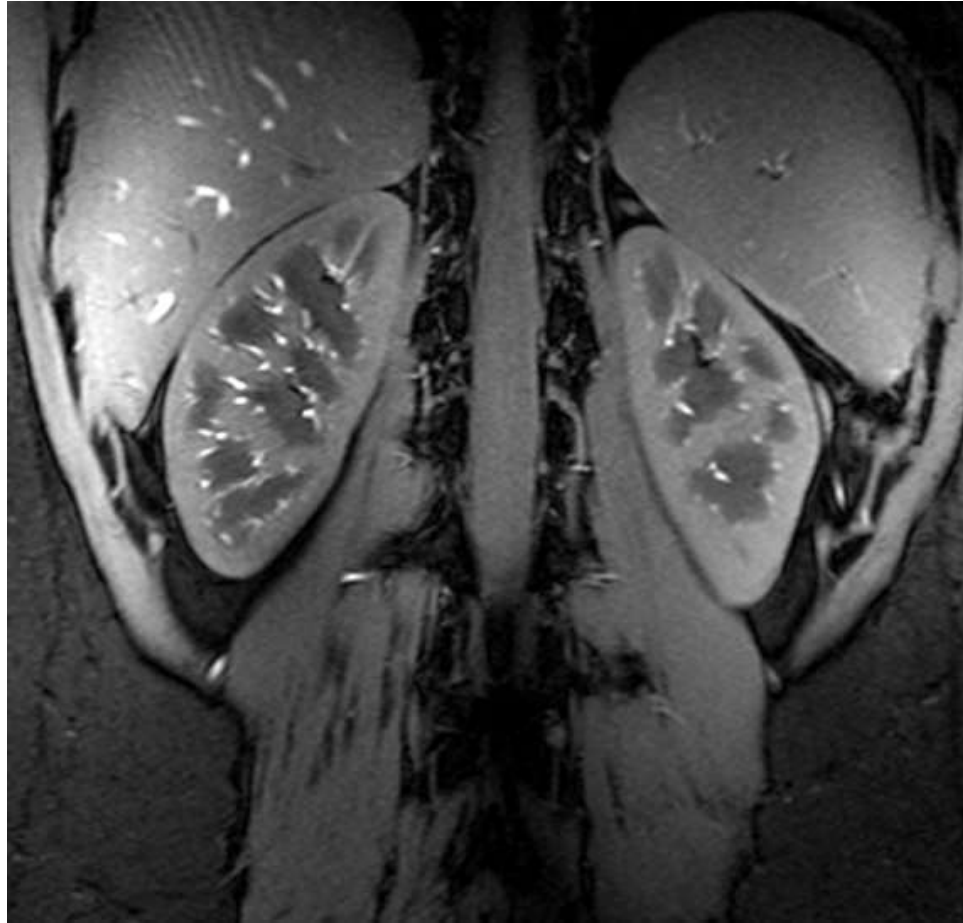
Nephrocalcinosis - two concrements (marked by red circles), which cannot be well distinguished from the hyperechogenic centre of the kidney

Instrumental methods: renal color Doppler



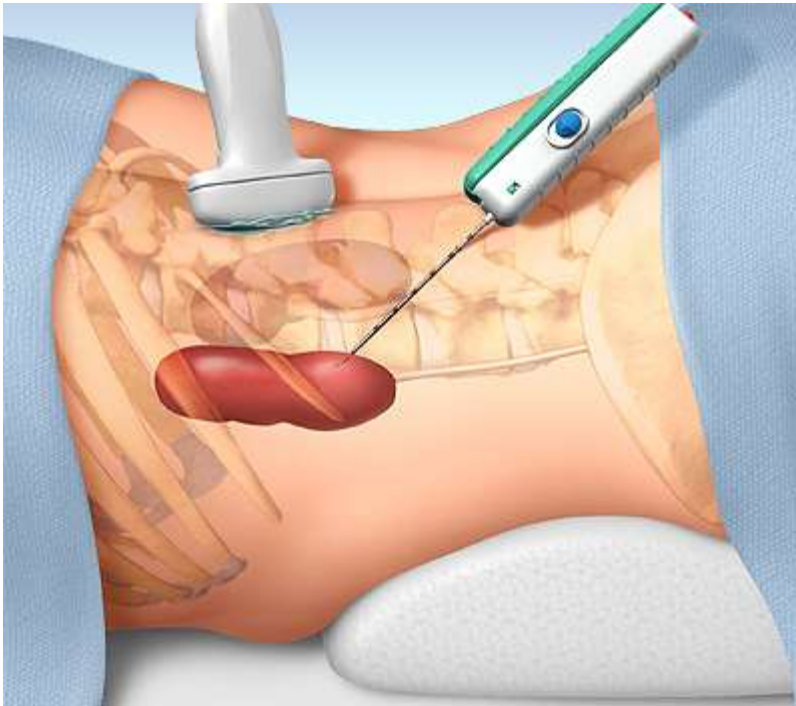
Normal renal arteries and renal veins

Instrumental methods: renal sonography



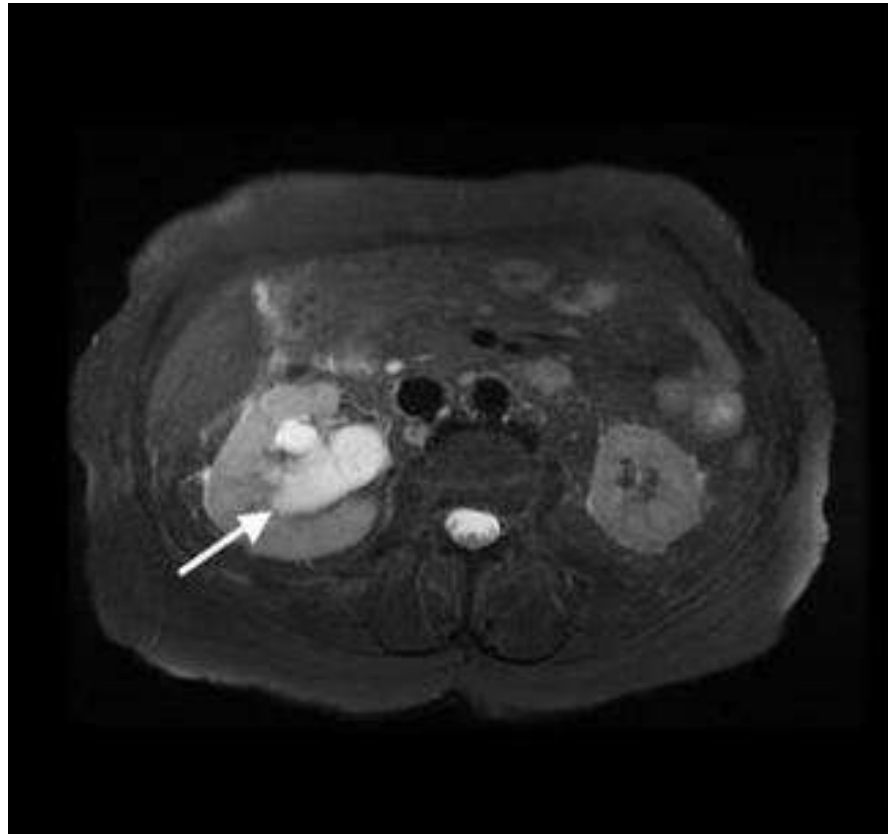
A high resolution gradient echo anatomic image of the kidneys

Instrumental methods: renal ultrasound biopsy



Ultrasound image showing the biopsy gun inside the lower pole of the kidney (arrows)

Instrumental methods: magnetic resonance imaging (MRI)



Contrast-enhanced MRI through the abdomen after cryoablation. The renal cell carcinoma has been fully treated

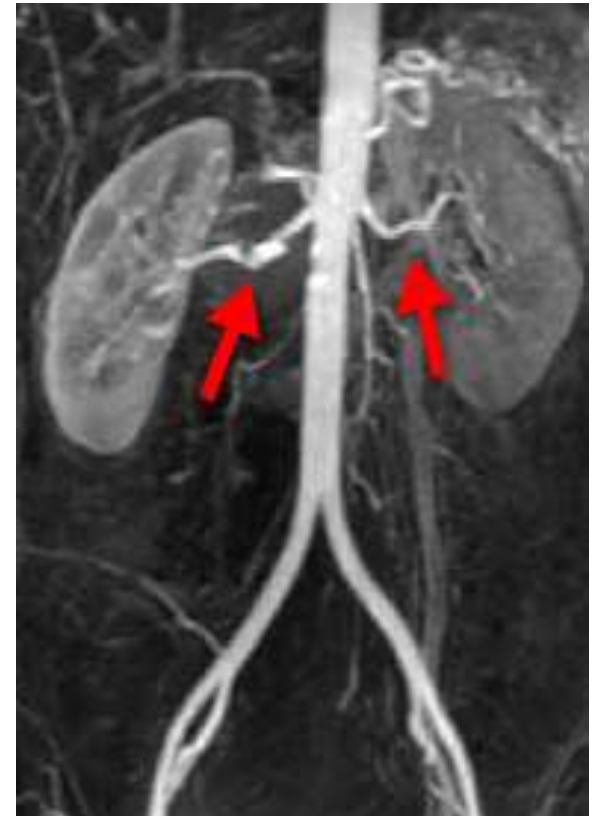
Instrumental methods: magnetic resonance imaging (MRI)



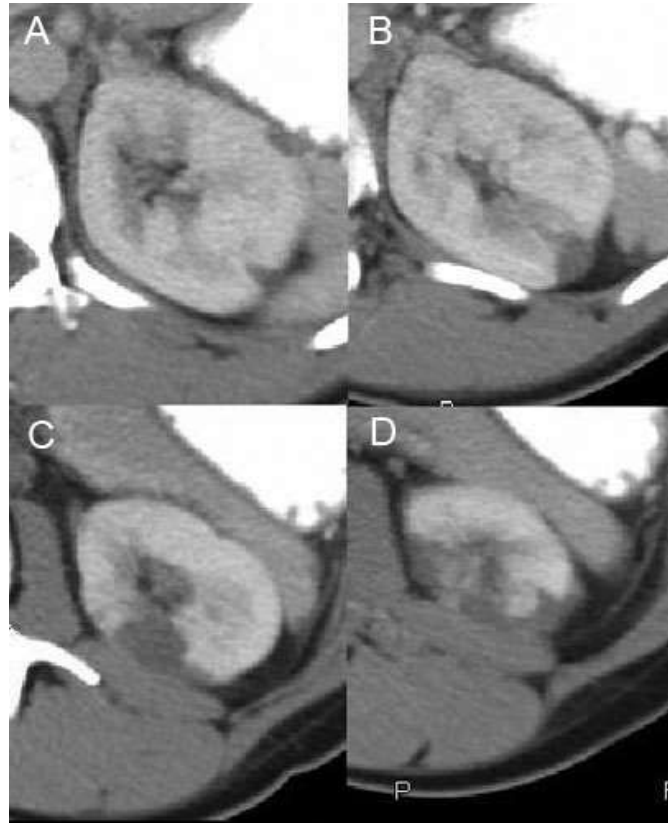
Multiple bilateral renal microcysts

Instrumental methods: magnetic resonance angiography (MRA)

- MRA stands for Magnetic Resonance Angiography
- It is an magnetic resonance imaging (MRI) technique that specifically evaluates vessels such as arteries
- Renal artery MRAs evaluate the vessels that supply blood to the kidneys to look for narrowing and blockage of the vessels, evaluate a suspected aneurysm, or look at the blood supply of a kidney tumor

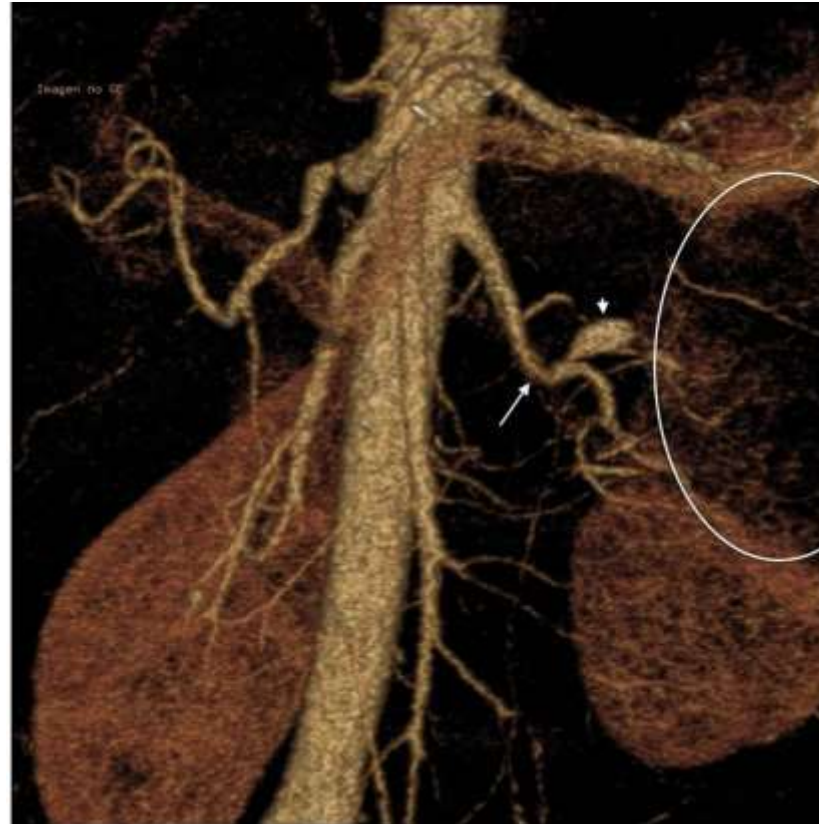


Instrumental methods: computer tomography



Acute renal infarction

Instrumental methods: computed tomography



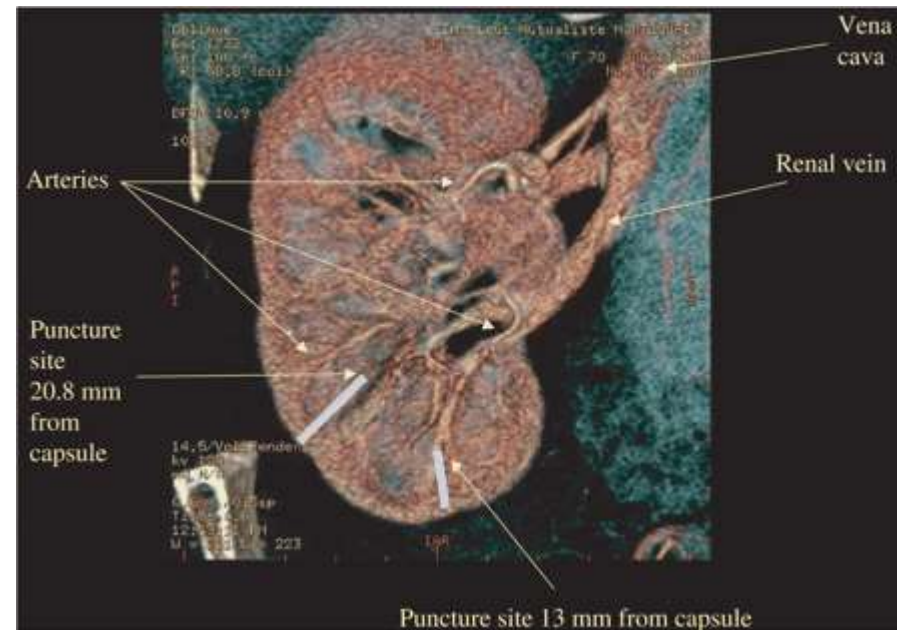
CT reconstruction of abdominal aorta showing mild stenosis before bifurcation of the left renal artery (oblique arrow), an aneurysm of a superior polar branch (arrow head) and a left kidney superior pole infarct (ellipse)

Instrumental methods: renal biopsy

A biopsy may be done occasionally for one of the following reasons:

- to identify a specific disease process and determine whether it will respond to treatment
- to evaluate the amount of damage that has occurred in the kidney
- to find out why a kidney transplant may not be doing well

A kidney biopsy is performed by using a thin needle with a sharp cutting edge to slice small pieces of kidney tissue for examination under a microscope



Transjugular renal biopsy. Three-dimensional computed tomography .

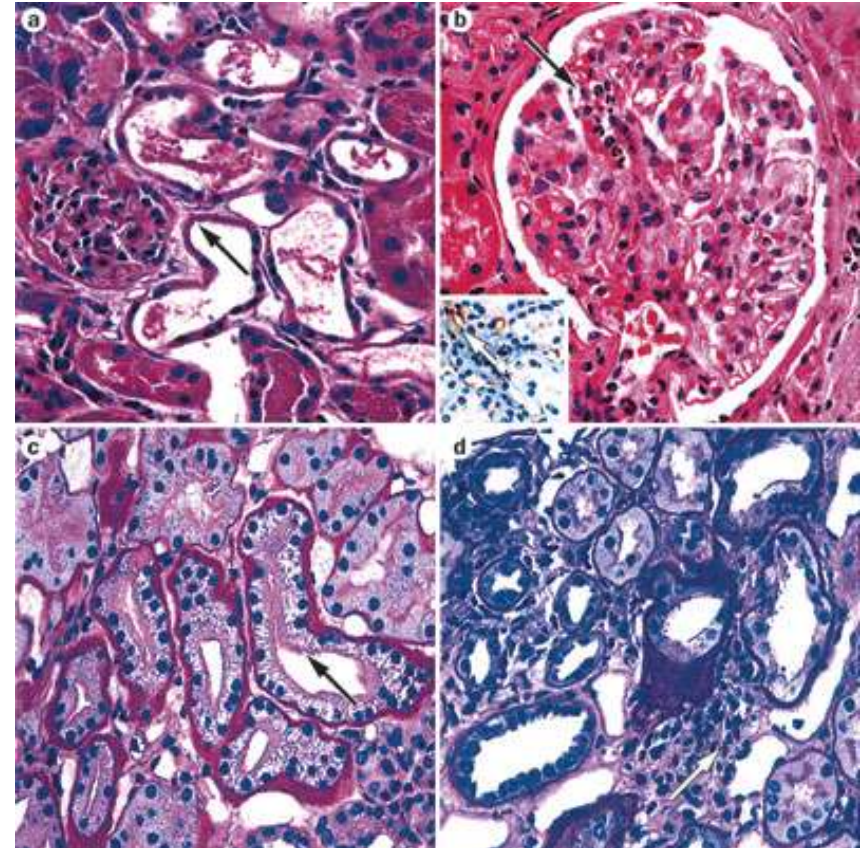
Instrumental methods: renal biopsy

a Acute tubular injury, with loss of brush borders and nuclei in proximal tubules (arrow) and little infiltrate

b Hyperacute rejection, with neutrophils in glomerular capillaries (arrow)

c Acute tubulopathy resulting from the toxic effects of calcineurin inhibitors, with characteristic isometric vacuolization (arrow)

d Urine leaks that cause obstruction typically demonstrate only a focal infiltrate (arrow), but can mimic acute cellular rejection



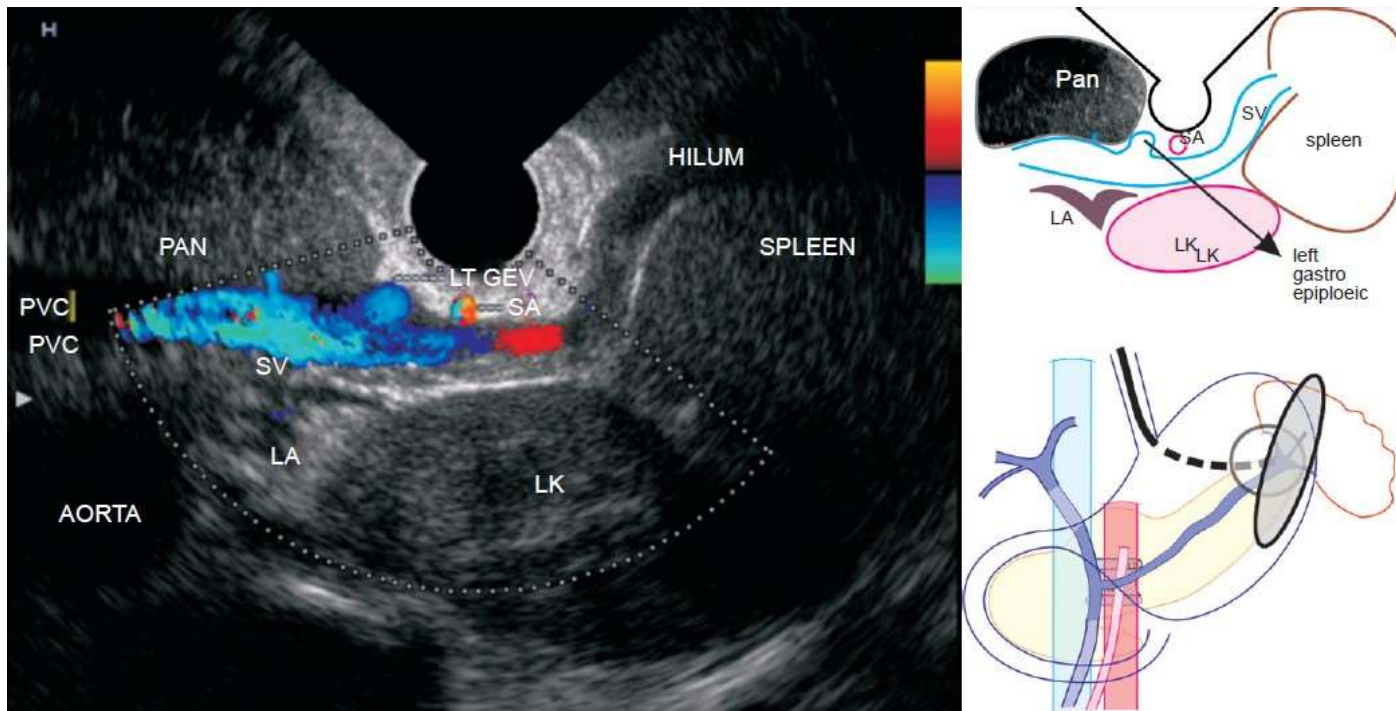
Pathological findings in renal biopsy samples taken 0–3 days after transplantation

Instrumental methods: angiography



Right renal angiography showing stenosis (small arrow) and an aneurysm (large arrow) of a medial branch near the renal hilum

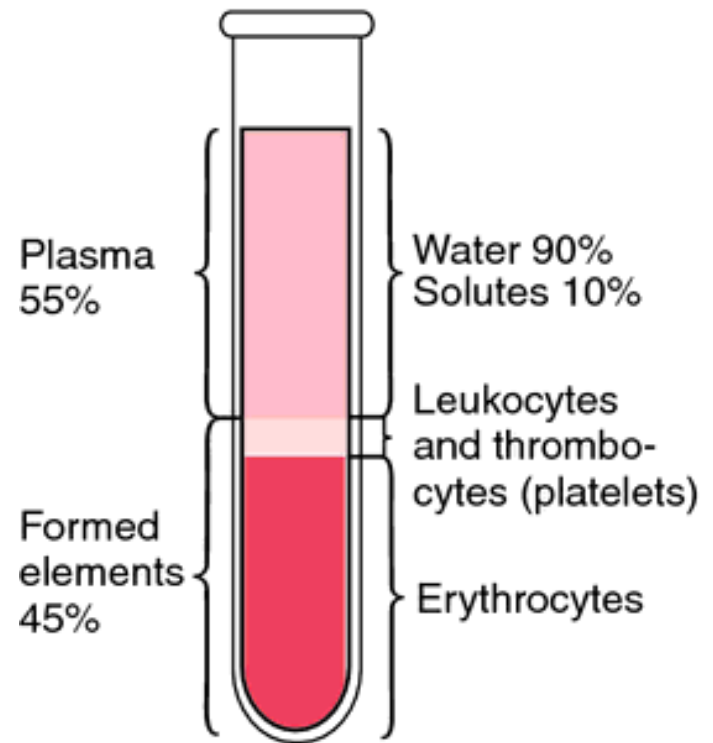
Instrumental methods: endoscopic ultrasonography



The spleen is enlarged and the splenic vein is seen taking the course anterior to the left kidney (5 o'clock)

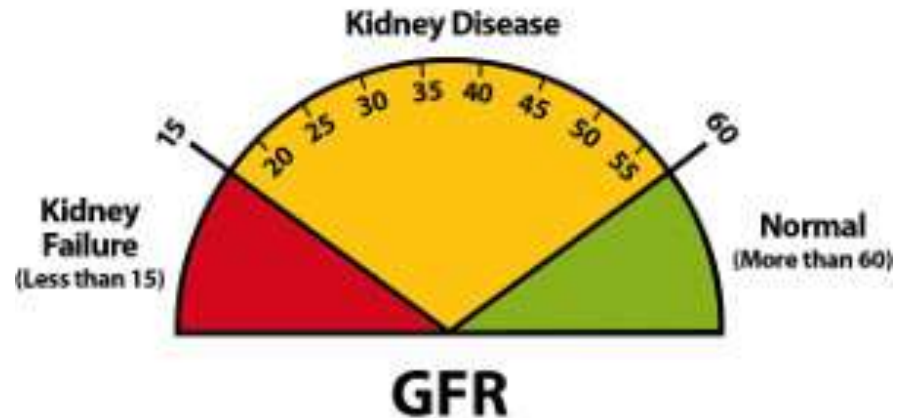
laboratory methods: Blood Tests

- Serum creatinine , glomerular filtration rate (GFR)
- Blood Urea Nitrogen (BUN)
- Hemoglobin in the blood
- Erythropoietin in the blood
- Electrolytes (sodium, potassium, chloride and bicarbonate)
- Parathyroid hormone (PTH), which controls calcium levels, is often increased in kidney disease
- Antinuclear antibody (ANA) in identifying an autoimmune condition such as lupus



laboratory methods: Blood Tests (glomerular filtration rate)

- Glomerular filtration rate (GFR) is the volume of fluid filtered from the kidney glomerular capillaries into the Bowman's capsule per unit time
- The GFR is typically recorded in units of volume per time, e.g., milliliters per minute mL/min
- In clinical practice the serum creatinine level is used to measure GFR

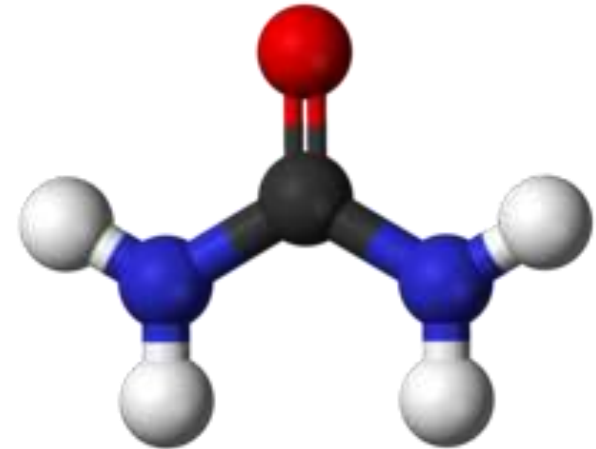


Chronic Kidney Disease stage	GFR level (mL/min/1.73 m ²)
1	≥ 90
2	60 – 89
3	30 – 59
4	15 – 29
5	< 15

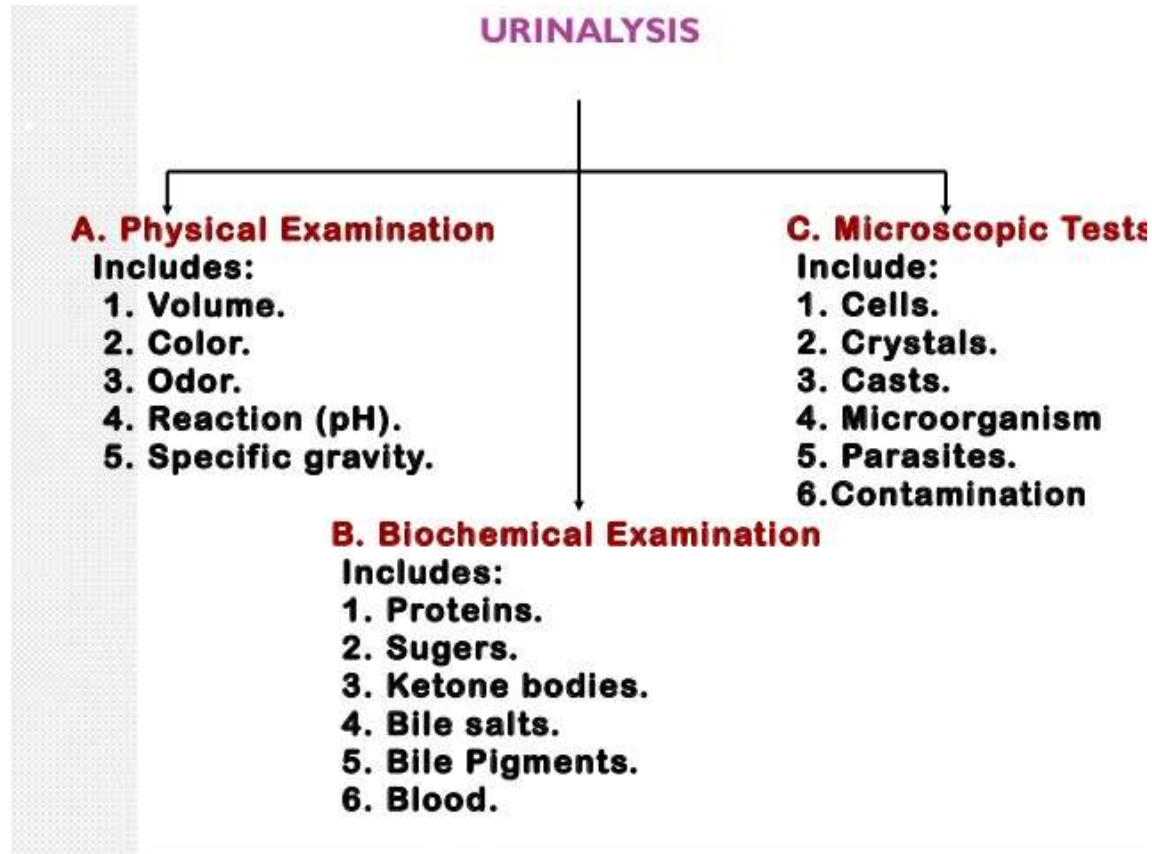
laboratory methods: Blood Tests

(Blood Urea Nitrogen)

- The liver produces urea in the urea cycle as a waste product of the digestion of protein
- Normal human adult blood should contain between 6 to 20 mg of urea nitrogen per 100 ml (6–20 mg/dL) of blood
- Blood urea nitrogen (BUN) is an indication of renal (kidney) health
- Normal ranges 1.8-7.1 mmol/L.
- The main causes of an increase in BUN are: high protein diet, decrease in glomerular filtration rate (GFR) (suggestive of renal failure) and in blood volume (hypovolemia), congestive heart failure, gastrointestinal hemorrhage, fever and increased catabolism



laboratory methods: urinalysis



The above urine chart can only give you an idea how the urine color can change in dehydration, but it is NOT a reliable tool to judge in which stage of dehydration you are

laboratory methods: urinalysis (volume)

- Polyuria – more than 2,000 ml/24-hours (diabetes mellitus type II and type I, diabetes insipidus, certain tumors of brain and spinal cord, acromegaly, myxedema, and certain kidney diseases, nonpathologic cause is usually increased fluid intake)
- Oliguria - which is a reduction in the total volume of urine excreted -less than 500 ml/24-hours (febrile states, excessive vomiting, severe diarrhea, or extreme dehydration, nonpathologic causes are decreased fluid intake and excessive sweating)
- Anuria - this term literally means "no urine" and refers to a complete lack of urine excretion



laboratory methods: urinalysis (color)



- Normal urine color results from a various pigments which are collectively referred to as urochrome
- The various shades of yellow in urine specimens vary with the intensity of the urochrome present and with the specific gravity
- Urine can show a typical coloration because of pathological conditions and as a result of the ingestion of certain substances, including food pigments, dyes, drugs, and so forth

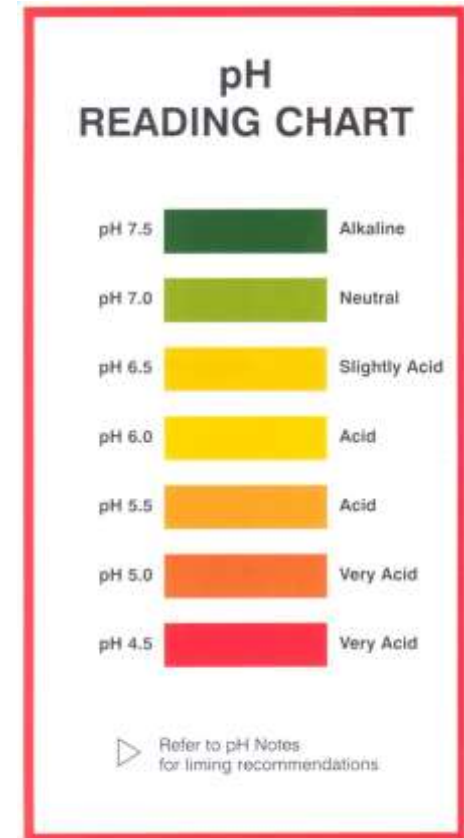
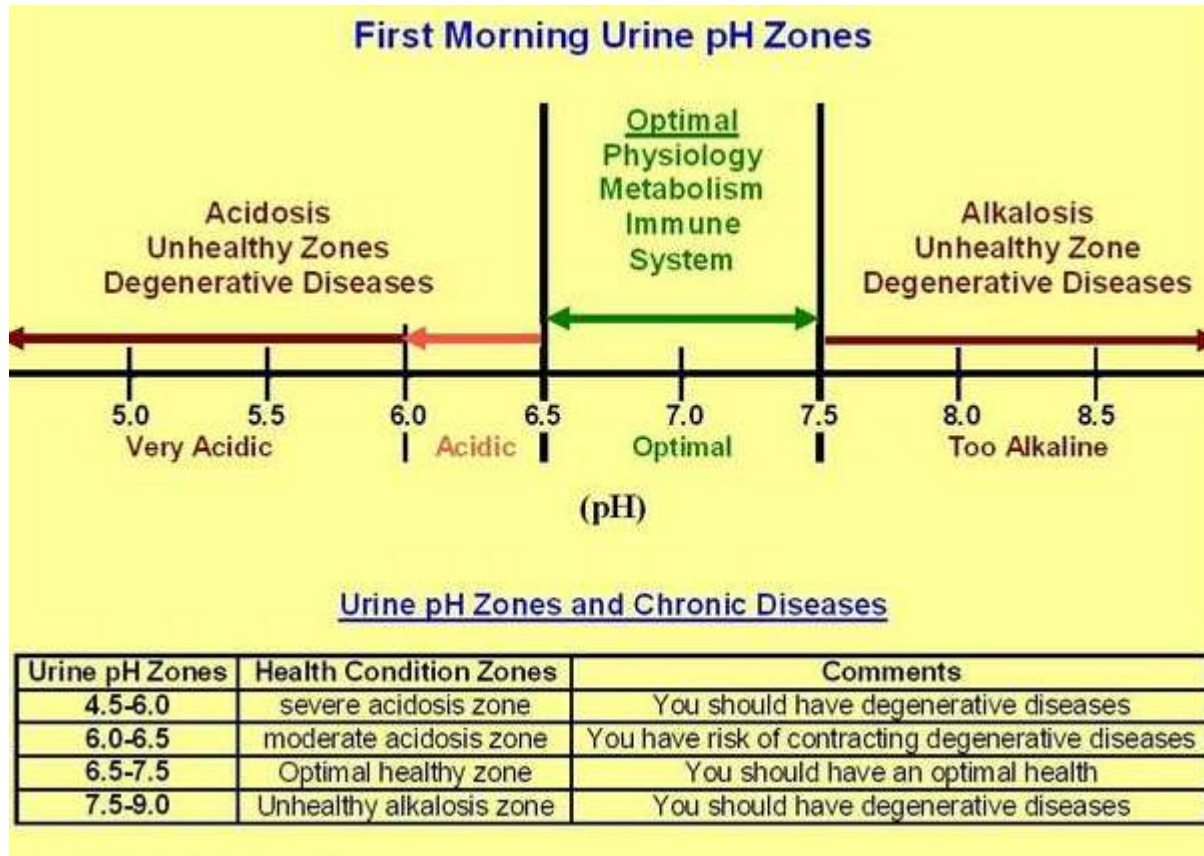
laboratory methods: urine color chart

Urine Color	Possible Meaning
Clear	Good hydration, overhydration or mild dehydration
Pale Yellow	Good hydration or mild dehydration
Bright Yellow	Mild or moderate dehydration or taking vitamin supplements
Orange, Amber	Moderate or severe dehydration
Tea-Colored	Severe dehydration

The above urine chart can only give you an idea how the urine color can change in dehydration, but it is NOT a reliable tool to judge in which stage of dehydration you are

laboratory methods: urinalysis

(reaction (pH))



laboratory methods: urinalysis (specific gravity)

- Specific gravity measures the kidney's ability to concentrate urine
- Specific gravity is a comparison of the density of urine to the density of distilled water, which is regarded as 1.000
- Generally, the greater the volume of urine excreted, the lower the specific gravity
- There is considerable variation in the specific gravity range of 1.003 to 1.030



Clinical refractometers

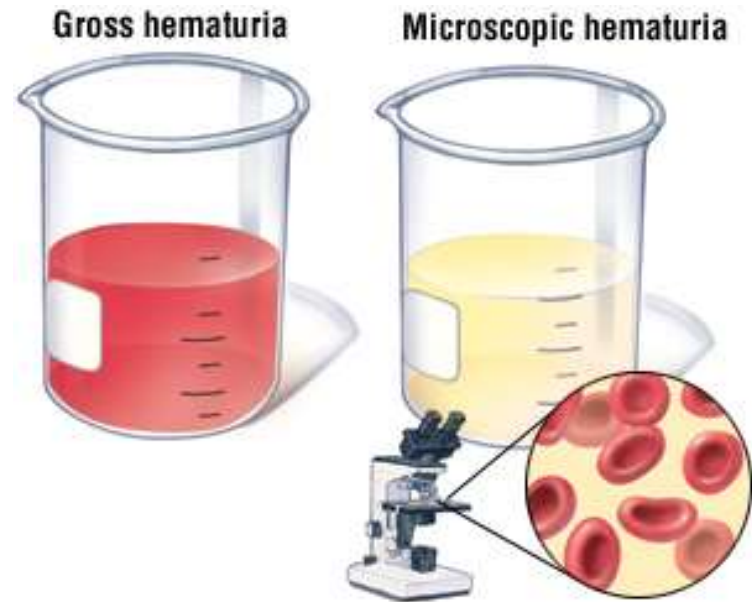
laboratory methods: urinalysis

(microscopic tests: cells and microorganisms)

- Cells, crystals, and other substances are counted and reported either as "none," "few," "moderate," or "many"
- Red Blood Cells (RBCs): normally, a few RBCs are present in urine sediment; inflammation, injury, etc. can cause RBCs to leak out of the blood vessels into the urine
- White Blood Cells (WBCs): the number of WBCs in urine sediment is normally low; when the number is high, it indicates an infection or inflammation somewhere in the urinary tract
- Epithelial Cells: normally, a few epithelial cells from the bladder or from the external urethra can be found in the urine sediment; in urinary tract conditions more epithelial cells are present
- Microorganisms (bacteria, yeasts) and parasites: in health, the urinary tract is sterile; bacteria from the surrounding skin can enter the urinary tract at the urethra and move up to the bladder, causing a urinary tract infection (UTI)

laboratory methods: urinalysis (microscopic tests: hematuria)

- Hematuria may be grossly visible (macroscopic hematuria) or detectable only on urine examination (microscopic hematuria)
- Gross hematuria, or macroscopic hematuria, is defined as blood that can be seen with the naked eye
- Microscopic hematuria is defined as the presence of more than 3 red blood cells (> 3 RBC) per high power field (HPF) in the centrifuged urinary sediment



laboratory methods: urinalysis (microscopic tests: leukocytes)

- Normally there are up to 0-2 leukocytes per high power field (HPF) or 10 per microlitre (μl) or mm^3
- Pyuria (the pus in urine) is defined as the presence of > 10 leucocytes per microlitre (μl) or mm^3 , and it can be sign of a bacterial urinary tract infection
- Sterile pyuria is the presence of elevated numbers of white cells (>10 white cells/ mm^3) in urine which appears sterile using standard culture techniques



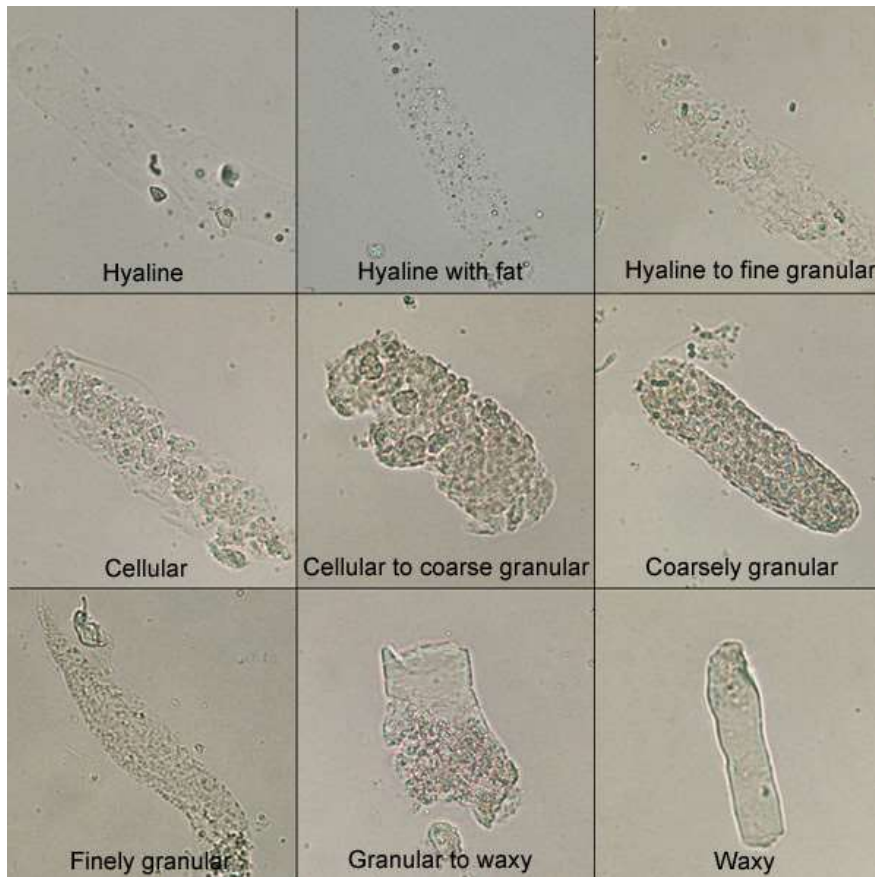
laboratory methods: urinalysis

(microscopic tests: casts and crystals)

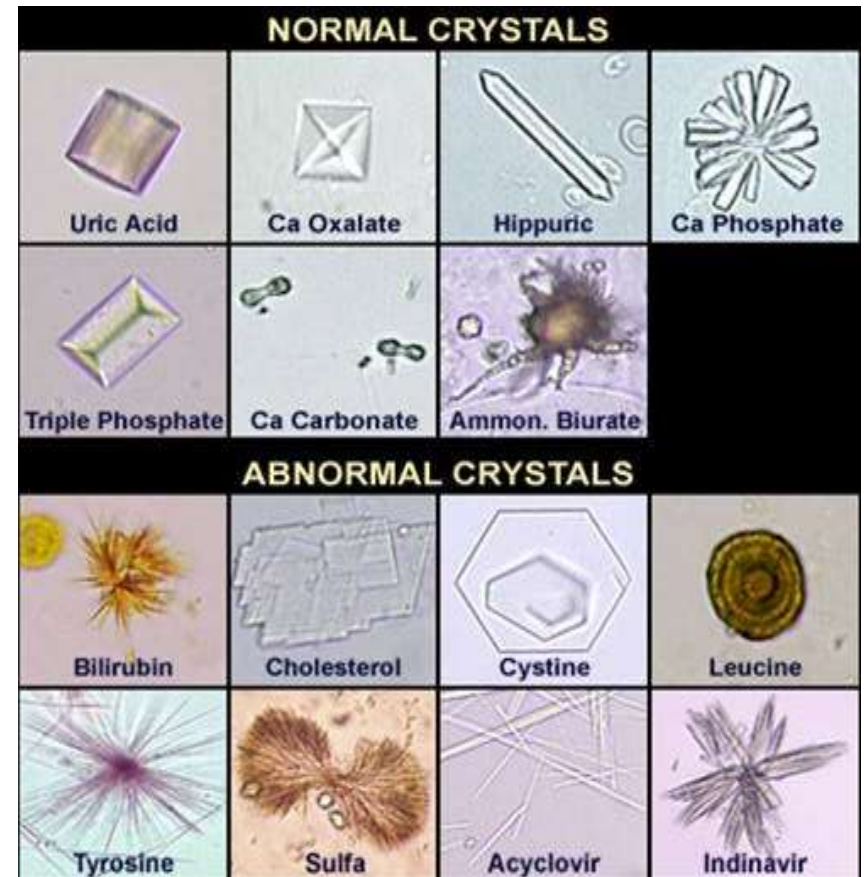
- Casts (cylindrical particles, they are formed from protein in the long, thin, hollow tubes of the kidneys known as tubules and usually take the shape of the tubule (hence the name)): normally, healthy people may have a few (0–5) hyaline casts per low power field (LPF); in the kidneys diseases, the cast is identified by the substances inside it, for example, as a red blood cell cast or white blood cell cast; different types of casts are associated with different kidney diseases
- Crystals: crystals are identified by their shape, color, and by the urine pH; crystals are considered "normal" if they are from solutes that are typically found in the urine (amorphous urates, crystalline uric acid, calcium oxalates, amorphous phosphates, calcium carbonate); if the crystals are from solutes that are not normally in the urine, they are considered "abnormal"; abnormal crystals may indicate an abnormal metabolic process and some of these include cystine, tyrosine, leucine; when crystals form as urine is being made in the kidney, they may group together to form kidney "stones" or calculi

laboratory methods: urinalysis

(casts and crystals)



Casts



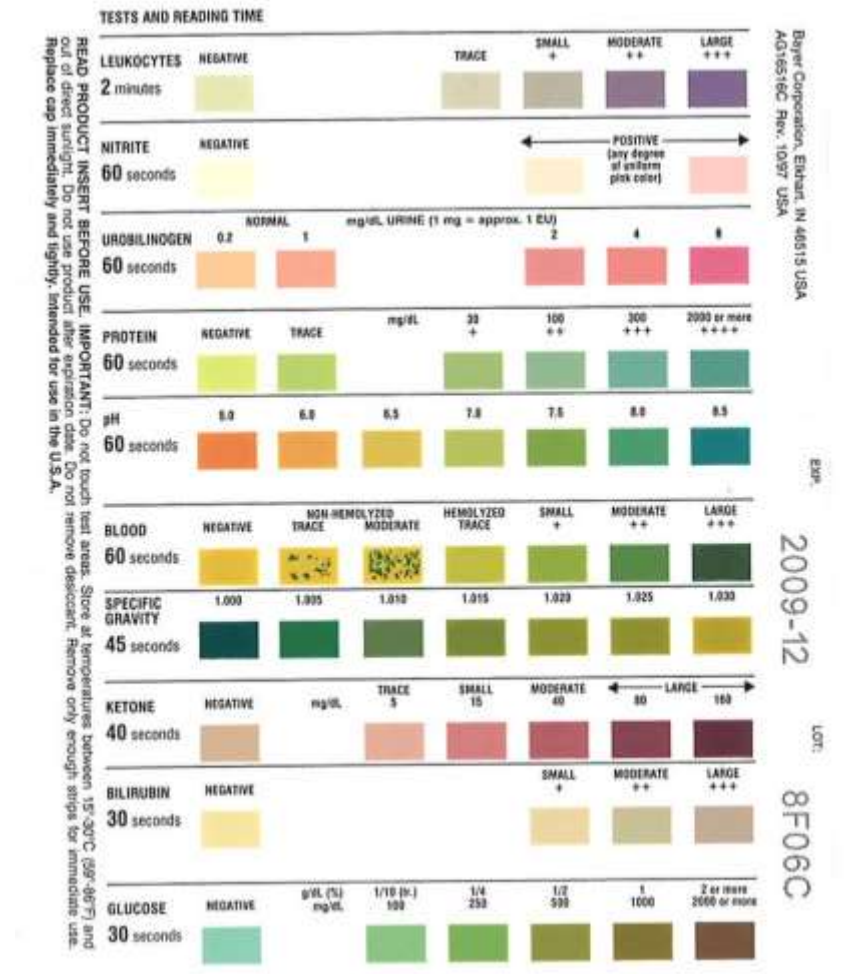
Crystals

laboratory methods: urinalysis (contamination)



Although the colony count is $>100,000$, this growth is considered contamination because more than three colony types are present

laboratory methods: urinalysis (biochemical examination)



Glossary of Patients Examination with Diseases of the Kidney

[Kidney Glossary of Terms](#)